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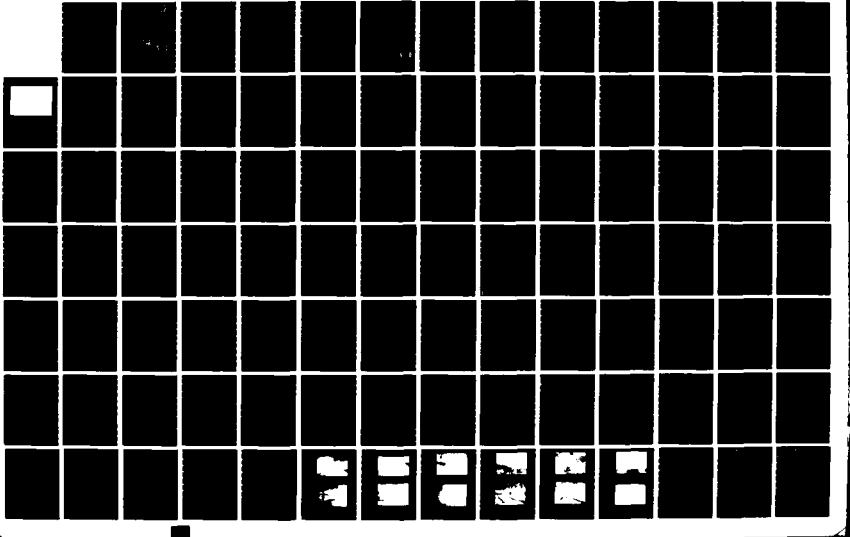
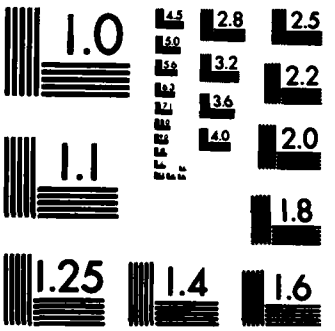
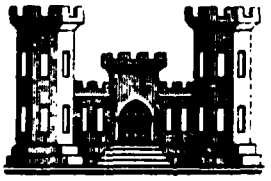




LOWER HOUSATONIC RIVER BASIN
HARWINTON , CONNECTICUT

LAKE HARWINTON DAM
CT 00367

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEER
WALTHAM , MASS. 02154

MAY 1980

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER CT 00367	2. GOVT ACCESSION NO. AD-A143982	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Lake Harwinton Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE May 1980 13. NUMBER OF PAGES 85
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18. SUPPLEMENTARY NOTES

Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Lower Housatonic River Basin
Harwinton, Connecticut

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Lake Harwinton Dam is an earth embankment structure 364 feet in length with a maximum height of 30 feet. The dam has a maximum storage volume of 344 acre-feet and a maximum height of 35 feet; the size classification is thus small. Based on the visual inspection, the dam and dike appear to be in fair condition, except for the downstream slope which is in poor condition. For the combination of the dam size (small) and downstream hazard classification (high) a range in the magnitude of the spillway test flood of ½ PMF to PMF is given.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254

REPLY TO
ATTENTION OF:

NEDED-E

6 OCT 1980

Honorable Ella T. Grasso
Governor of the State of Connecticut
State Capitol
Hartford, Connecticut 06115

Dear Governor Grasso:

Inclosed is a copy of the Lake Harwinton Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. The report is based upon a visual inspection, a review of past performance, and a preliminary hydrological analysis. A brief assessment is included at the beginning of the report.

The preliminary hydrologic analysis has indicated that the spillway capacity for the Lake Harwinton Dam would likely be exceeded by floods greater than 48% percent of the Probable Maximum Flood (PMF), the test flood for spillway adequacy. Our screening criteria specifies that a dam of this class which does not have sufficient spillway capacity to discharge fifty percent of the PMF, should be adjudged as having a seriously inadequate spillway and the dam assessed as unsafe, non-emergency, until more detailed studies prove otherwise or corrective measures are completed.

The term "unsafe" applied to a dam because of an inadequate spillway does not indicate the same degree of emergency as that term would if applied because of structural deficiency. It does indicate, however, that a severe storm may cause overtopping and possible failure of the dam, with significant damage and potential loss of life downstream.

It is recommended that within twelve months from the date of this report the owner of the dam engage the services of a professional or consulting engineer to determine by more sophisticated methods and procedures the magnitude of the spillway deficiency. Based on this determination, appropriate remedial mitigating measures should be designed and completed within 24 months of this date of notification. In the interim a detailed emergency operation plan and warning system should be promptly developed. During periods of unusually heavy precipitation, round-the-clock surveillance should be provided.

NEDED-E
Honorable Ella T. Grasso

I have approved the report and support the findings and recommendations described in Section 7, with qualifications as noted above. I request that you keep me informed of the actions taken to implement these recommendations since this follow-up is an important part of the non-Federal Dam Inspection Program.

A copy of this report has been forwarded to the Department of Environmental Protection, the cooperating agency for the State of Connecticut. This report has also been furnished to the owner of the project, Lake Harwinton Association, Harwinton, CT 06790.

Copies of this report will be made available to the public, upon request to this office, under the Freedom of Information Act, thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Protection for the cooperation extended in carrying out this program.

Sincerely,

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

LAKE HARWINTON DAM

CT 00367

LOWER HOUSATONIC RIVER BASIN

HARWINTON, CONNECTICUT

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Identification No.:	CT 00367
Name of Dam:	Lake Harwinton Dam
Town:	Harwinton
County and State:	Litchfield, Connecticut
Stream:	Catlin Brook
Date of Inspection:	15 November, 1979

BRIEF ASSESSMENT

Lake Harwinton Dam is an earth embankment structure 364 feet in length with a maximum height of 30 feet. An earth dike is located north of the dam and they are separated by approximately 80 feet of natural higher ground. The dike is 187 feet in length and has a maximum height of 35 feet. A paved road occupies the crest of the dam and dike.

The spillway is located at the left abutment of the dam. It consists of an unlined flat approach channel from the reservoir, a concrete crest 25 feet long, and a concrete discharge channel 25 feet long with a 15 percent slope.

The purpose of the dam is to impound Lake Harwinton for recreational use. The dam has a maximum storage volume of 344 acre-feet and a maximum height of 35 feet; the size classification is thus small.

A residential home and a school are located within the dam failure impact area. The house would be subject to flooding of approximately 10 feet above the first floor elevation. A school is located about 5,000 feet downstream of the dam, east of Route 4, within the flood hazard area. The school would be subject to flooding approximately 4 feet above the first floor elevation. With the potential for the loss of more than a few lives and excessive economic losses the dam has been classified as having a "high" hazard potential.

Based on the visual inspection, the dam and dike appear to be in fair condition, except for the downstream slope of the dam which is in poor condition. The project has been rated as "poor". Minor cracks were observe in asphalt pavement that traverses the crest of the dam. Settlement of 1 to 2 inches was noted in pavement adjacent to the right side of spillway. The vertical and horizontal

alignment of the dam/dike was good. Considerable erosion has occurred on the downstream slope of the dam in the vicinity of the right abutment. Some sloughing of the riprap on the upstream slope near the crest was evident. Seepage including several small springs was noted downstream from the toe of the dam. Heavy brush and small trees were observed on the downstream slope. The dike is generally in overall fair condition. No unusual embankment or downstream seepage was observed on the dike.

For the combination of the dam size (small) and downstream hazard classification (high) a range in the magnitude of the spillway test flood of 1/2 PMF to PMF is given. A spillway test flood of 1/2 PMF was selected for this project. The maximum spillway capacity without overtopping the dam is 544 CFS. The capacity of the spillway is adequate to pass 95 percent of the test flood outflow (575 CFS) without overtopping the dam and dike.

Within one year of receipt of the Phase I Inspection Report, the owner should retain a qualified registered engineer to accomplish the following: 1) Establish procedures for removal of the trees and rotting stumps on the downstream slope of the dam embankment, and within 10 ft of the downstream toe, including selection of suitable fill materials for backfilling the voids left after removal of the tree root systems. 2) Investigate the seepage occurring downstream from the toe of the dam embankment and design remedial measures, if necessary. 3) Determine the existing geometry of the downstream slope of the right embankment by survey, after the heavy brush on the slope has been cleared, evaluate the stability of the existing slope geometry, and design remedial measure, if necessary. 4) Design erosion protection for the downstream slope of the dam embankment where the corrugated metal culvert discharges onto the slope near the right abutment 5) Design corrective measures for the spillway discharge channel to prevent undermining of the concrete floor by erosion and to prevent the erosion of the right bank of the channel occurring just downstream from the concrete lined section and 6) Conduct more refined hydrologic and hydraulic analysis to determine the need for and methods of increasing the project discharge capacity. The owner should carry out the recommendations of the engineer.

The owner should also carry out the following operational and maintenance procedures: 1) Place additional riprap on the upstream slope in areas where the existing riprap does not provide complete coverage of the slope. 2) Remove brush from the embankment slopes and from within 10 ft of the downstream toe. 3) Cut the trees growing at the left abutment of the dike embankment. 4) Engage a qualified registered engineer to make a comprehensive technical inspection once a year. 5) Repair all spalled concrete areas of the service (road) bridge passing over the spillway and 6) Establish a surveillance program for use during and immediately after heavy rainfall, and also a warning program to follow in case of emergency conditions.

S. Giavara

S. Giavara, P.E.
President

Registered CT 7634

Th Phase I Inspection Report on Lake Harwinton Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

RICHARD DIBUONO, MEMBER
Water Control Branch
Engineering Division

ARAMAST MAHTESIAN, MEMBER
Geotechnical Engineering Branch
Engineering Division

CARNEY M. TERZIAN, CHAIRMAN
Design Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation: however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

The Phase I Investigation does not include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

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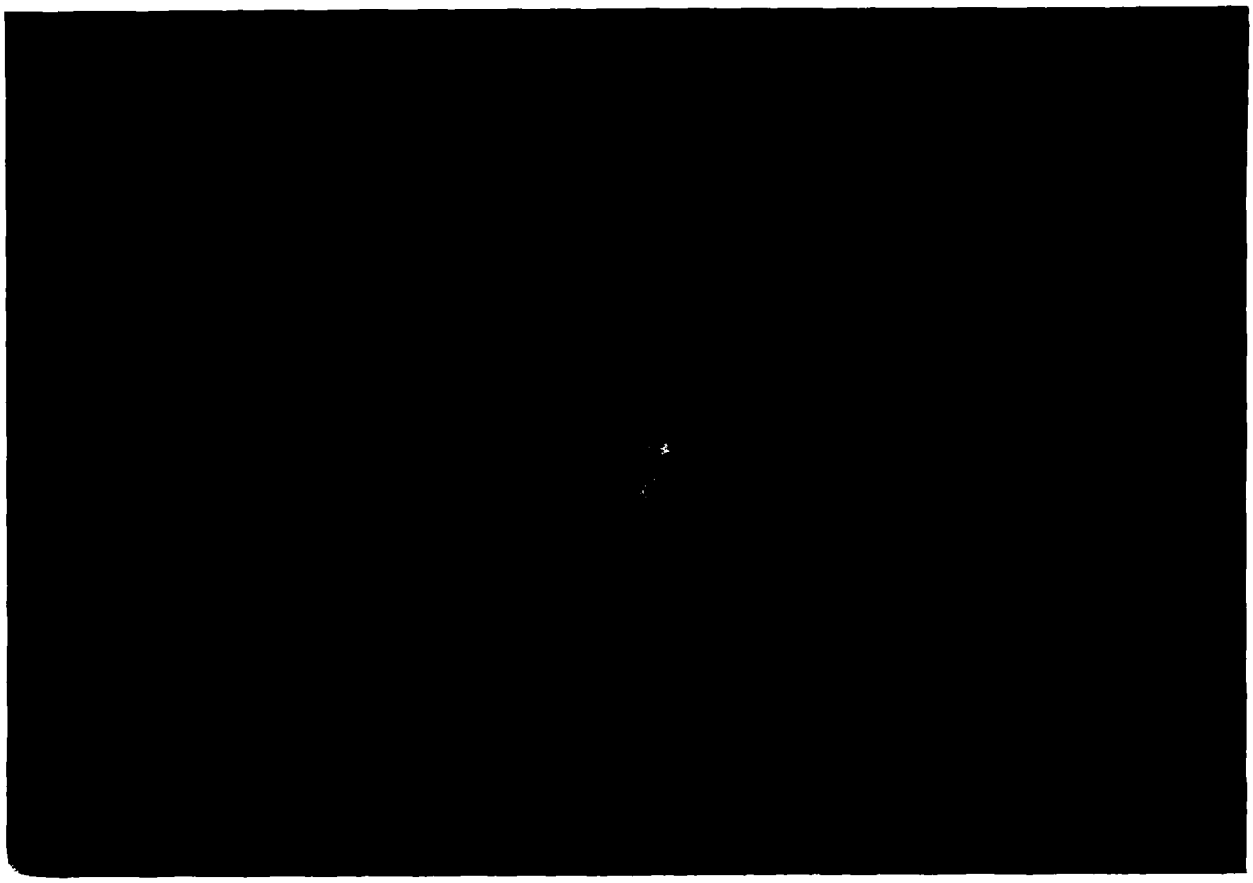
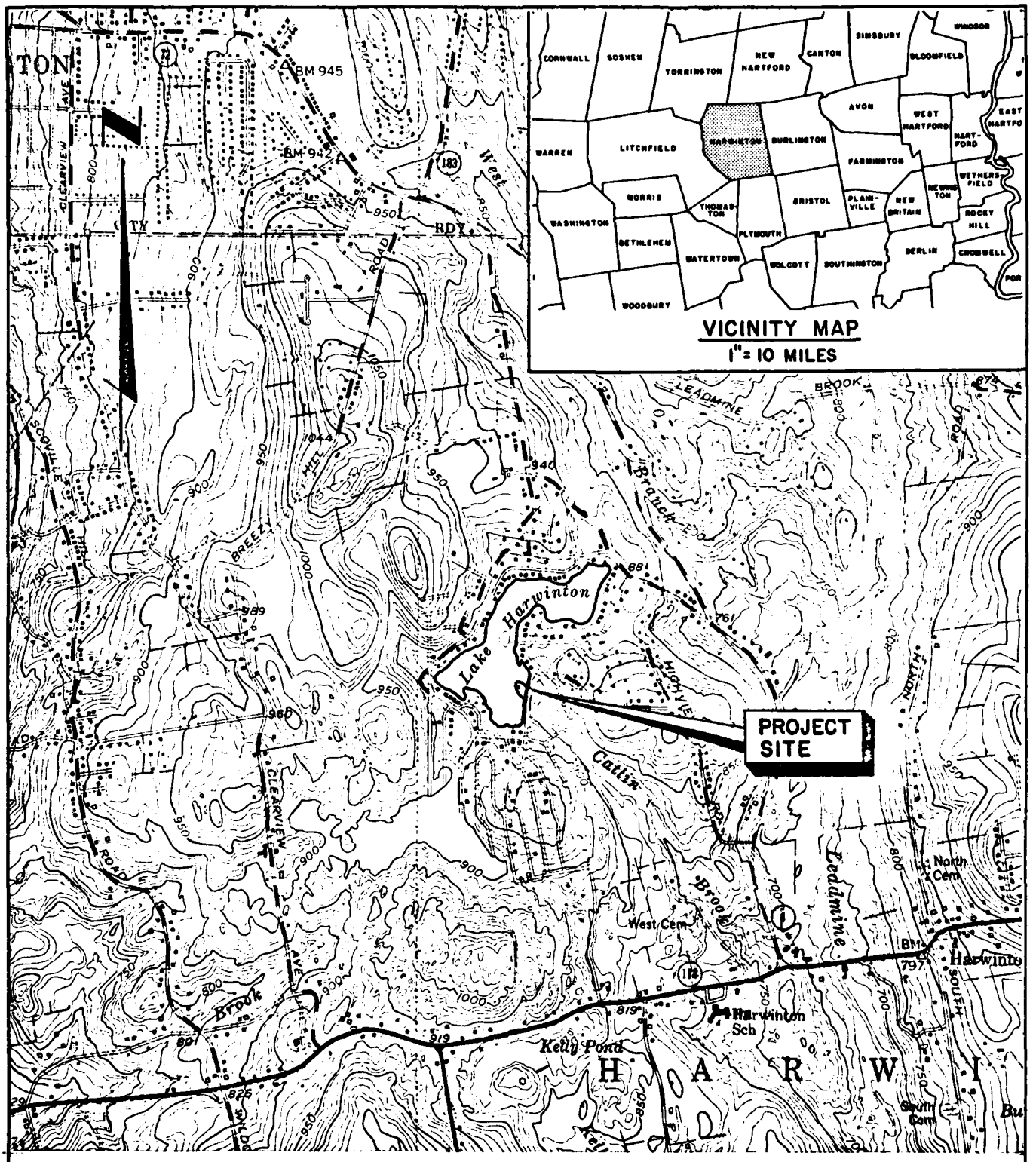
APPENDIXES



OVERVIEW PHOTO
Lake Harwinton Dam



SCALE IN FEET

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LAKE HARWINTON DAM

LOCATION MAP

HARWINTON , CONNECTICUT

FLAHERTY • GIAVARA ASSOCIATES, P.C.

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT
LAKE HARWINTON DAM - CT 00367

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL:

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection through the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Flaherty Giavara Associates, P.C. has been retained by the New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed was issued to Flaherty Giavara Associates, P.C. under a letter of 19 October 1979 from William E. Hodgson, Jr., Colonel, Corps of Engineers. Contract No. DACW33-80-C-0001 has been assigned by the Corps of Engineers for this work.

b. Purpose.

1) Perform technical inspection and evaluation of non-federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-federal interests.

2) Encourage and assist the States to initiate quickly effective dam safety programs for non-federal dams.

3) To update, verify and complete the National Inventory of Dams.

1.2 DESCRIPTION OF THE PROJECT:

a. Location. Lake Harwinton is located in Harwinton, Connecticut approximately one mile northwest of the Village of Harwinton and approximately 2 miles southeast of the City of Torrington. Access to the dam is from Connecticut Route 4 north of Harwinton. The lake is shown on the U.S.G.S. topographic map "Torrington, Connecticut" at a latitude of 41° 46' 44'' and a longitude of 73° 04' 53''. The Location Map on page vi shows the location of the dam.

b. Description of Dam and Appurtenances. Lake Harwinton Dam is an earth embankment structure 364 feet in length with a maximum height of 30 feet. An earth dike is located north of the dam and they are separated by approximately 80 feet of natural higher ground. The dike is 187 feet in length and has

a maximum height of 35 feet. A paved road occupies the crest of the dam and dike.

The crest of the dam is approximately 25 feet in width. Its elevation varies from El. 860.8 to El. 861.1 NGVD. The upstream face of the dam slopes at 2.5 H to 1 V and is protected with riprap (6 inch to 1 foot diameter). The downstream embankment slopes at 1 H to 1 V and is overgrown with brush and trees.

The crest of the dike is approximately 25 feet long. The crest is generally at El. 861.8 NGVD. The upstream face of the dike also slopes at 2.5 H to 1 V and is protected with riprap (6 inch to 1 foot diameter). The downstream dike embankment is grassed and slopes at 3 H to 1 V.

The spillway is located at the left abutment of the dam. It consists of an unlined flat approach channel from the reservoir, a concrete crest (8 inches high by 25 feet wide), and a concrete discharge channel 25 feet long with a 15 percent slope. The concrete bridge abutments form the spillway training walls.

The outlet works consist of a submerged intake structure, a concrete control box with a manual valve control, and a 12 inch concrete pipe which passes through the dike. The outlet works pass through the dike embankment near its right abutment. The outlet control box is below ground level with a metal cover. It is located adjacent to the roadway on the upstream side of the dam.

c. Size Classification. Lake Harwinton has a storage volume of 344 acre feet and a maximum height of 35 feet. A storage volume of greater than 50 acre-feet but less than 1000 acre-feet and a dam height of greater than 25 feet but less than 40 feet classifies this structure in the "small" category according to guidelines established by the Corps of Engineers.

d. Hazard Classification. The dam is classified as having a "high" hazard potential. A residential home and a school are located within the flood hazard area. The house would be subject to flooding of approximately 10 feet above the first floor elevation. A school is located about 5,000 feet downstream of the dam, east of Route 4 within the flood hazard area. The school would be subject to flooding approximately 4 feet above the first floor elevation. With the potential for the loss of more than a few lives and excessive economic losses the dam has been classified as having a "high" hazard potential.

e. Ownership. The dam is owned by the Lake Harwinton Association, B. Cagenello, President, Phone: 203-482-2011.

f. Operator. The dam is operated by the Lake Harwinton Association, B. Cagenello, President, Phone: 203-482-2011.

g. Purpose of Dam. The purpose of the dam is to impound Lake Harwinton for recreational use by members of the Lake Harwinton Association.

h. Design and Construction History. The original construction date of this dam is unknown. The original dam is purported to have "failed" in 1938 and was reconstructed in the 1940's. There is no design or construction information available for the reconstructed or original dam. Repair work to the dike was undertaken in 1969 to correct a severe seepage condition through the structure purportedly a cracked concrete core wall. The repairs were designed by Kratzert and Jones, Civil Engineers and constructed by T. Cannavo Construction.

The repairs consisted of excavating unsuitable material on the downstream dike embankment and forming a new embankment slope (3 H to 1 V). The outlet pipe (12 inch concrete) was extended to the new toe of slope and a concrete endwall and seepage collars constructed. A seepage collection system consisting of 6 inch perforated A.C.C.M.P. was also installed within the dam embankment with the outlet at the endwall. The specifications for the construction called for the removal of unsuitable materials on the downstream embankment of the dike and the formation of the new embankment with bank run gravel compacted in 6 inch lifts to 95 percent of the dry density. In addition, the specifications refer to a reverse filter construction which is not shown on the available plans.

i. Normal Operation Procedure. The outlet works are normally closed; therefore, the water level is maintained principally by the spillway crest elevation. During the fall, the outlet works are opened to allow the lake level to be lowered for dock repairs, beach maintenance, etc.

1.3 PERTINENT DATA:

a. Drainage Area. The drainage area is 0.76 square miles of upland terrain surrounding Lake Harwinton. The watershed characteristics vary from wooded to agricultural, with moderate residential development located around the perimeter of the lake.

b. Discharge at Dam Site.

1) The outlet works consists of a submerged intake structure, a concrete control box with valving, and a 12 inch concrete pipe which passes through the base of the dike. The inlet elevation of the outlet pipe is estimated to be El. 827 NGVD, with a corresponding discharge capacity of 22 CFS.

2) There are no known records of past floods or flood stage heights at the dam.

3) The ungated spillway capacity at the top of dam - 544 CFS @ El. 860.8.

4) The ungated spillway capacity at the test flood elevation - 566 CFS @ El. 860.9.

5) The gated spillway capacity at normal pool elevation is not applicable at this dam.

6) The gated spillway capacity at test flood elevation is not applicable at this dam.

7) The total spillway capacity at test flood elevation - 566 CFS @ El. 860.9.

8) The total project discharge at the top of dam - 544 @ El. 860.8.

9) The total project discharge at test flood elevation - 575 CFS @ El. 860.9.

c. Elevation. (Feet above NGVD)

1) Streambed at toe of dam.....827±

2) Bottom of cut-off.....Unknown

3) Maximum tailwater.....830±

4) Recreation pool.....N/A

5) Full flood control pool.....N/A

6) Spillway crest.....857

7) Design surcharge (original design).....Unknown

8) Top of dam..... Dam: 860.8-861.1
Dike: 861.8

9) Test flood design surcharge.....860.5

d. Reservoir (Length in feet)

1) Normal pool.....3,000±

2) Flood control pool.....N/A

3) Spillway crest pool.....3,000±

4) Top of dam.....3,100±

5) Test flood pool.....3,100±

e. Storage. (acre-feet)

1) Normal pool.....140

2) Flood control pool.....N/A

3) Spillway crest pool.....140

4) Top of dam.....344

5) Test flood pool.....340

f. Reservoir Surface.(acres)

1) Normal pool.....33

2) Flood control pool.....N/A

3) Spillway crest.....33

4) Test flood pool.....45

5) Top of dam.....45

g. Dam.

1)	Type:	Dam & Dike: Earth embankment, concrete spillway at dam
2)	Length:	Dam: 364 feet Dike: 187 feet
3)	Height:	Dam: 30 feet Dike: 35 feet
4)	Top Width:	
5)	Side Slopes:	Dam: U/S 2.5 H to 1 V, D/S 1 H to 1 V Dike: U/S 2.5 H to 1 V, D/S 3 H to 1 V
6)	Zoning:	Concrete core
7)	Impervious Core:	Unknown
8)	Cut-off:	Unknown
9)	Grout Curtain:	Unknown

h. Diversion and Regulating Tunnel.

1)	Type:	N/A
2)	Length:	N/A
3)	Closure:	N/A
4)	Access:	N/A
5)	Regulating Facilities:	N/A

i. Spillway.

1)	Type:	Broad crested concrete slab with crest
2)	Length of Weir:	25 feet
3)	Crest Elevation:	857 feet
4)	Gates:	None
5)	U/S Channel	Reservoir
6)	D/S Channel:	Concrete discharge channel (25 feet) followed by natural channel

j. Regulating Outlets.

1)	Invert:	827 feet NGVD
2)	Size:	12 inch diameter
3)	Description:	Concrete pipe
4)	Control Mechanism:	Manually operated valve box

SECTION 2 - ENGINEERING DATA

2.1 DESIGN:

No design data is available for this dam.

2.2 CONSTRUCTION:

No information relative to the Construction of the original dam is available. Information presented in this report was primarily obtained by interviews and direct field measurements of the existing dam and dike. The following information on post-construction changes was reviewed:

a. Correspondence from John J. Mazzochi and Associates to the State Water Resources Commission dated January 15, 1969 containing a summary of site observations made between May 17 and October 17, 1968.

b. A drawing prepared by Kratzert & Jones, Civil Engineers titled "Plan Showing Repairs for Harwinton Dam" and dated January 1969.

c. A letter prepared by Connecticut Testing Company, Inc. dated October 24, 1969 containing the results of grain size analyses and compaction tests performed during repairs to Harwinton Dam.

2.3 OPERATION DATA:

Formal operation records are not available for this dam.

2.4 EVALUATION:

a. Availability. There are no plans, specifications or computations available from the Owner regarding the design or construction of the original dam. Subsequent repairs and modifications to this dam are well documented and available.

b. Adequacy. The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspections, past performance and sound engineering judgment.

c. Validity. There is no reason to question the validity of the available data.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS:

a. General. Based on the visual inspection, the dam and dike appear to be in fair condition, except for the downstream slope of the dam which is in poor condition. The project has been rated as "poor". The dam consists of two earth embankment sections (Dam and Dike) separated by a natural island located near the center of the dam. The geometry and condition of the downstream slopes of the dam and dike embankments differ significantly and they are described in separate subsections below. A concrete spillway section is located at the left abutment of the dam. The water level in the reservoir was several feet below the spillway crest at the time of inspection.

Minor cracks were observed in asphalt pavement that traverses the crest of the dam. Settlement of 1 to 2 inches was noted in the pavement adjacent to the right side of spillway. The vertical and horizontal alignment of the dam/dike was good. Considerable erosion has occurred on the downstream slope of the dam in the vicinity of the right abutment. Some sloughing of riprap on the upstream slope near the crest was evident. Seepage, including several small springs was noted downstream from the toe of the dam. Heavy brush and small trees were observed on the downstream slope. The dike is generally in overall fair condition. No unusual embankment or downstream seepage was observed.

b. Dam.

1) Upstream Slope - The upstream slope of the dam is covered with riprap and crushed stone up to the crest, as shown in Photo No. 2. Three different materials are present on the upstream slope. Small angular riprap (generally less than 1 ft diameter) partially covers the upper portion of the slope. Crushed stone (2 in. maximum size) underlies the small angular riprap and is exposed over about 25-50% of the slope area. Somewhat larger and more rounded riprap partially covers the lower portion of the slope. The crushed stone and small angular riprap appear to have been placed more recently than the larger rounded riprap.

Sloughing of the riprap and crushed stone on the upstream slope has occurred in several areas. At STA 3+05 and STA 6+20, sloughing has occurred in 5-ft-wide areas near the crest, exposing some of the underlying embankment soil. Riprap is missing from a large area on the lower portion of the upstream slope at the left abutment of the dam. An erosion gully at the right abutment of the spillway has been filled in with concrete. Small brush is growing through the riprap on the upstream slope and several trees (less than 1 ft diameter) are growing at the left abutment of the dam.

2) Crest - An asphalt paved roadway runs along the crest of the dam/dike as shown in Photo No. 1. Minor cracks were observed in the asphalt pavement, but there is no indication that these cracks are associated with any movement of the embankment. The pavement appears to have settled about 1-2 in. in a small area at the right abutment of the bridge spanning the spillway.

3) Downstream Slope - The downstream slope of the dam is heavily overgrown with brush and small trees, as shown in Photos No. 4 and No. 6 and a number of large rotting tree stumps (up to 2 ft diameter) were observed on the slope. The slope is uneven and the average inclination of the slope appears to vary from one location to another. The upper 15 to 20 ft of the slope appears to be very steep (up to 1 H: 1 V). A number of erosion gullies and scarps were observed on the slope, particularly in the upper portion near the crest. A large erosion gully (5 ft wide and 2-3 ft deep) was observed near the right abutment at about STA 0+90.

A 20-in-diameter corrugated metal culvert exits on the downstream slope near the right abutment at about STA 0+50, as shown in Photo No. 5. A small amount of water was discharging from the culvert at the time of inspection. The discharge from the culvert has carved an erosion gully into the slope.

A wet area was observed at the downstream toe at about STA 1+50 (Photo No. 6) The ground surface was saturated and spongy in this area. A large area of standing water was observed about 50-75 ft downstream from the toe of the embankment at about STA 2+00. Seepage was observed flowing from a small spring in this area and from two other small springs about 25 and 50 ft further downstream. The seepage from the springs had no visible turbidity. A rust-colored staining was observed in the vicinity of the springs. Much of the area between the standing water at STA 2+00 and the spillway discharge channel was wet.

4) Dike - The downstream slope of the dike is broader and flatter than the downstream slope of the dam, as shown in Photos No. 3 and No. 7. The slope is grass covered with only minor growth of brush. A paved drainage ditch, channels runoff from the roadway on the crest down to the outlet channel located at the toe of the slope. No significant erosion was observed on the slope.

5) Spillway - A concrete spillway section is located at the left abutment of the dam as shown in Photo No. 8. The spillway weir and training walls are concrete. The approach channel is unlined with soil floor. The discharge channel has a concrete floor and mortared stone masonry walls extending about 25-30 ft downstream from the spillway weir. The downstream

end of the concrete floor has been undermined by erosion, as shown in Photo No. 9. The erosion extends at least 4 ft back underneath the concrete floor.

The downstream spillway channel is shown in Photo No. 11. The channel is strewn with several large logs and brush is growing in the channel floor. Bedrock outcrops on the left side of the channel were observed just downstream of the concrete-lined section. This bedrock outcrop apparently deflects the spillway discharge towards the right wall of the channel, which is badly eroded in an area about 25 ft downstream from the concrete-lined section. A vertical erosion scarp up to 5 ft high with an overhang supported by tree roots of up to 3 ft has formed in this area.

c. Appurtenant Structures. The outlet works consist of a submerged intake structure, a concrete control box with valving, and a 12 inch concrete pipe which passes through the dike embankment. The outlet works with the exception of the outlet pipe at the discharge point were not visible for inspection. The concrete control box is located below ground level on the upstream side of the dike adjacent to the roadway. This structure was not accessible and therefore was not inspected. The visible portion of the concrete outlet pipe was in good condition. (See photo No. 10) The outlet works channel is approximately 10 feet wide with wooded banks and a sand and gravel bed. The outlet works was discharging at the time of field inspection to lower the lake level and was reported to be operable.

d. Reservoir Area. The perimeter of the reservoir is moderately sloping and partially wooded. Residential homes are located around a majority of the lake. There is no evidence of slides or slope failures. No sediment deposits were observed above the water level of the reservoir. (The reservoir area is shown in Photo No. 12).

e. Downstream Channel. The channel below the spillway is approximately 10 feet wide with vegetated banks (brush and small trees) and a bed of sand and gravel. Some channel degradation was observed below the previously described ledge area. The spillway and outlet works channel join several hundred feet below the dam.

f. Bridge. The road bridge spanning the spillway is in fair condition. The bridge deck is deteriorating as evidenced concrete spalling.

3.2 EVALUATION:

Based on the visual inspection, the dam and dike appear to be in fair condition except for the downstream slope of the dam which is in poor condition. The inspection disclosed the following

items relating to the dam's downstream slope which require attention:

a. The downstream slope is heavily overgrown with brush and small trees, and a number of large rotting tree stumps are present on the slope. Uprooting of trees by high winds and rotting of the root systems of tree stumps left in the embankment could provide pathways for seepage and lead to internal erosion (piping) of the embankment.

b. The upper 15 to 20 ft of the slope appears to be unusually steep.

c. Considerable erosion has occurred on the slope.

d. A corrugated metal culvert discharges onto the slope near the right abutment, causing erosion on the slope.

e. Seepage, including several small springs, was observed downstream from the toe of the right embankment. It should be noted that the reservoir level was relatively low at the time the seepage was observed.

The following items relating to other portions of the dam require attention:

a. Sloughing of the riprap and crushed stone on the upstream slope has occurred in several areas and small brush is growing through the riprap.

b. Several trees are growing at the left abutment of the Dike.

c. The downstream end of the concrete floor of the spillway discharge channel has been undermined by erosion.

d. Severe erorion has occurred along the right bank of the spillway discharge channel about 25 ft downstream from the concrete-lined section.

SECTION 4 - OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 OPERATIONAL PROCEDURES:

a. General. The outlet structure for the dam is operable and the water level for Lake Harwinton can be controlled. The blow-off outlet is opened to lower the lake for dock repairs, beach maintenance, etc.

b. Description of any Warning System in Effect. There is no warning system of any kind in effect at the dam. There are no formal emergency operation plans in effect for lowering the water level in anticipation of severe storms.

4.2 MAINTENANCE PROCEDURES:

a. General. Maintenance of the dam appears to be generally lacking.

b. Operating Facilities. There are no formal maintenance procedures followed for the operating facilities.

4.3 EVALUATION:

Regular operational maintenance for this dam and its appurtenances has not been developed or implemented.

An emergency action plan should be prepared to prevent or minimize the impact of failure. This plan should list the expedient action to be taken and authorities to be contacted.

SECTION 5 - EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 GENERAL DATA:

Lake Harwinton Dam is an earth embankment structure with a length of-364 feet. A broad crested concrete spillway section 25 feet in length is located at the left abutment of the dam. An earth dike is located to the north of main dam and they are separated by approximately 80 feet of natural higher ground. The earth dike is 187 feet in length. The maximum height of the dam and dike is 35 feet. A paved roadway 20 feet in width traverses the crest of the dam and dike embankment.

The crest elevations of the dam and dike vary. The crest of the dam varies in elevation from El. 860.8 NGVD to El. 861.1 NGVD. The crest of the dike is generally at El. 861.8 NGVD. These elevations are based on an assumed spillway crest elevation of 857 NGVD.

The spillway functions as a broad crested weir. The approach from the reservoir is flat sloping and unlined. The concrete spillway discharge channel is 25 feet in length and slopes at 15 percent. At the end of the concrete spillway discharge channel the channel consists of ledge rock followed by a natural watercourse. A road bridge spans the spillway allowing approximately 5 feet of unrestricted flow below the structure.

The outlet works consists of a submerged intake structure, a concrete control box with valving, and a 12 inch concrete pipe which passes through the base of the dike. The outlet pipe passes through the dike embankment near the right abutment.

The watershed area is 0.76 square miles of upland terrain surrounding Lake Harwinton. The watershed characteristic varies from wooded to agricultural. Moderate residential development is located around the perimeter of the lake. Future development within the watershed is expected to be moderate.

There are no impoundments or significant storage areas upstream of this dam. The lake is fed by several small tributary streams.

5.2 DESIGN DATA:

There is no design data available for this dam. In lieu of existing design information, U.S.G.S. Topographic Maps (scale 1" = 2000') were used to develop hydrologic parameters. Pertinent hydraulic design data was obtained by actual field measurements at the time of field inspection.

5.3 EXPERIENCE DATA:

There is no known experience data available for this dam.

5.4 TEST FLOOD ANALYSIS:

The test flood for determining the spillway adequacy is based upon Corps of Engineers guidelines. The size of the dam is "small" based on a storage volume of 344 acre-feet and a dam height of 35 feet. The dam is classified as "high" hazard.

The potential for the loss of more than a few lives is anticipated should the dam fail. A school located downstream of the dam is within the flood hazard area. Corps of Engineers guidelines for a "small" dam with a "high" hazard classification gives a range for the test flood from ½ PMF to PMF. The probable maximum flood (PMF) is the flood that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region.

The test flood selected for this dam is the ½ PMF based on consideration of the dam's height and storage volume.

The magnitude of the test flood was determined using methods developed by the Soils Conservation Service as described in "Design of Small Dams" by the Bureau of Reclamation. A triangular hydrograph was developed based on a test flood flow of 870 CFS and a runoff volume of 20 inches.

The developed hydrograph was routed through the reservoir using a computer program based on stage-storage and stage-discharge data. The pond was assumed to be full and level with the spillway crest prior to the storm event. In addition, it was assumed that the outlet conduit was closed throughout the test flood duration.

The test flood hydrograph routed through the reservoir resulted in a maximum lake level of 860.9 feet NGVD corresponding to a peak outflow rate of 575 CFS. The flow reduction represents an attenuation of 34 percent. The maximum depth of flow at the spillway is 3.9 feet. A maximum lake level of 860.9 would result in the overtopping of the dam by 0.1 feet and 1.0 feet of freeboard at the dike. The spillway passes 95 percent of the test flood outflow without overtopping the dam.

5.5 DAM FAILURE ANALYSIS:

The downstream impact of dam failure was analyzed using a computer program developed based upon the Corps of Engineers "Rule of Thumb Guidance for Estimating Dam Failure Hydrographs" dated April 1978 as used in the National Dam Inspection Program.

The peak outflow rate is calculated by combining the dam failure outflow and the pre-failure discharge. Water surface elevations are calculated for both the pre-failure and post-failure conditions at selected stations downstram of the dam. The output data (see Appendix D) is used to define flood prone areas and select the hazard classification of the dam.

Based on an assumed breach width equal to 40 percent of the total length of the dam and dike at mid-height, the total peak outflow due to a flood wave would be 82,300 CFS. This includes a flow in the downstream watercourse of 550 CFS equivalent to the maximum spillway discharge at the dam.

A residential home and a school are located within the flood hazard area. The home is located approximately 3,500 feet downstream of the dam and would be subject to flooding approximately 10 feet above the first floor elevation. The maximum depth of flow at this location prior to and after dam failure is 3 and 18 feet respectively.

A school associated with an episcopal church is located approximately 5,000 feet downstream of the dam, east of Route 4, within the flood hazard area. This school would be subject to flooding approximately 4 feet above the first floor elevation due to a dam failure. The maximum depth of flow at this location prior to and after dam failure is 3 and 8 feet respectively. These structures would not be subject to flooding due to the flood stage prior to dam failure.

It is anticipated that loss of life would be more than a few and economic loss would be appreciable should a dam failure occur.

SECTION 6 - EVALUATION OF STRUCTURAL STABILITY

6.1 VISUAL OBSERVATIONS:

The visual inspection did not disclose any immediate stability problems. However, the trees and rotting tree stumps on the downstream slope, the erosion on the downstream slope, and the seepage downstream from the toe of the dam could affect the future stability of the dam.

6.2 DESIGN AND CONSTRUCTION DATA:

No original design and construction data are available.

6.3 POST-CONSTRUCTION CHANGES:

The following information on post-construction changes was reviewed:

a. Correspondence from John J. Mazzochi and Associates to the State Water Resources Commission dated January 15, 1969 containing a summary of site observations made between May 17 and October 17, 1968.

b. A drawing prepared by Kratzert & Jones, Civil Engineers titled "Plan Showing Repairs for Harwinton Dam" and dated January 1969.

c. A letter prepared by Connecticut Testing Company, Inc. dated October 24, 1969 containing the results of grain size analyses and compaction tests performed during repairs to Harwinton Dam.

These documents indicate that:

a. The original roadway along the crest of the dam had been widened to accommodate two way traffic prior to 1968 by dumping fill on the slope, which steepened the slope to approximately 1 H: 1 V and blocked the controlled outlet in the dike embankment.

b. Serious seepage and piping had developed on the downstream slope of the left embankment as of June 1968.

c. Trees were growing on the upstream slopes of the embankments and were cut flush with the ground when they were cleared in 1968.

d. Repairs were made to the dike embankment in 1969, consisting of widening and flattening the downstream slope by addition of pervious fill. The pipe for the controlled outlet

was extended further downstream.

6.4 SEISMIC STABILITY:

Lake Harwinton Dam is located in Seismic Zone 1 and, in accordance with the recommended Phase I inspection guidelines, does not warrant seismic stability analysis.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 DAM ASSESSMENT:

a. Condition. Based on a visual inspection, the dam and dike appear to be in fair condition, except for the downstream slope of the dam embankment which is in poor condition. The project has been rated as "poor". There are some features which could affect the long term performance of the dam if they are not corrected as recommended in Sections 7.2 and 7.3.

b. Adequacy. The engineering information available was very limited and thus assessment of the condition of the dam was based primarily on the results of the visual inspection, past operational performance of the structure and sound engineering judgement.

c. Urgency. The recommendations and remedial measures presented in Sections 7.2 and 7.3 should be implemented by the owner within one year after receipt of this Phase I inspection report.

7.2 RECOMMENDATIONS:

The owner should retain a qualified registered engineer to accomplish the following:

a. Establish procedures for removal of the trees and rotting stumps on the downstream slope of the dam embankment, and within 10 ft of the downstream toe, including selection of suitable fill materials for backfilling the voids left after removal of the tree root systems.

b. Investigate the seepage occurring downstream from the toe of the dam embankment and design remedial measures, if necessary.

c. Determine the existing geometry of the downstream slope of the right embankment by survey, after the heavy brush on the slope has been cleared, evaluate the stability of the existing slope geometry, and design remedial measures, if necessary.

d. Design erosion protection for the downstream slope of the dam embankment where the corrugated metal culvert discharges onto the slope near the right abutment.

e. Design corrective measures for the spillway discharge channel to prevent undermining of the concrete floor by erosion and to prevent the erosion of the right bank of the channel occurring just downstream from the concrete lined section.

f. Conduct more refined hydrologic and hydraulic analysis to determine the need for and methods of increasing the project discharge capacity.

The owner should carry out the recommendations made by the engineer.

7.3 REMEDIAL MEASURES:

a. Operating and Maintenance Procedures. The owner should:

1) Place additional riprap on the upstream slope in areas where the existing riprap does not provide complete coverage of the slope.

2) Brush should be removed from the embankment slopes and from within 10 ft of the downstream toe.

3) The trees growing at the left abutment of the dike embankment should be cut.

4) Engage a qualified registered engineer to make a comprehensive technical inspection once a year.

5) Repair all spalled concrete areas of the service (road) bridge passing over the spillway.

6) Establish a surveillance program for use during and immediately after heavy rainfall, and also a warning program to follow in case of emergency conditions.

7.4 ALTERNATIVES:

There are no practical alternatives to the recommendations contained in Sections 7.2 and 7.3.

APPENDIX A

INSPECTION CHECK LIST

INSPECTION CHECK LIST

PARTY ORGANIZATION

PROJECT Lake Harwinton Dam

DATE November 15, 1979

TIME 1000

WEATHER 45° F - Sunny

W.S. ELEV.____ U.S.____ DN.S.

PARTY:

1. R. Smith, FGA, Project Manager
2. P.Burgess, FGA, Hydraulics/Hydrology
3. R. Murdock, GEI, Geotechnical
4. D. Shields, GEI, Geotechnical
5.

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

PERIODIC INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Lake Harwinton Dam DATE: Nov. 15, 1979

AREA EVALUATED	CONDITIONS
DAM EMBANKMENT	
Crest Elevation	860.8 - 861.1 NGVD
Current Pool Elevation	853 NGVD
Maximum Impoundment to Date	Unknown
Surface Cracks	None observed.
Pavement Condition	Minor cracks in asphalt pavement.
Movement or Settlement of Crest	1-2 in. settlement of pavement adjacent to right side of spillway.
Lateral Movement	None observed.
Vertical Alignment	Good.
Horizontal Alignment	Good.
Condition at Abutment and at Concrete Structures	Considerable erosion on downstream slope at right abutment. Trees on upstream slope at left abutment.
Indications of Movement of Structural Items on Slopes	None observed.
Trespassing on Slopes	Trash dumped on downstream slope of right embankment.
Sloughing or Erosion of Slopes or Abutments	Erosion of downstream slope of right embankment.
Rock Slope Protection - Riprap Failures	Some sloughing of riprap on upstream slope near crest. Riprap missing in lower portion of slope near left abutment.
Unusual Movement or Cracking at or near Toes	None observed.
Unusual Embankment or Downstream Seepage	Seepage, including several small springs, downstream from toe of right embankment.
Piping or Boils	None observed.
Foundation Drainage Features	None observed.
Toe Drains	None observed.
Instrumentation System	None.
Vegetation	Heavy brush and small trees on downstream slope of right embankment. Small brush on other slopes.

PERIODIC INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Lake Harwinton Dam DATE: Nov. 15, 1979

AREA EVALUATED	CONDITIONS
DIKE EMBANKMENT	
Crest Elevation	861.8 NGVD
Current Pool Elevation	853 NGVD
Maximum Impoundment to Date	Unknown
Surface Cracks	None observed.
Pavement Condition	Minor cracks in asphalt pavement.
Movement or Settlement of Crest	None
Lateral Movement	None observed.
Vertical Alignment	Good
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	Trees at right abutment and near toe of slope (left side)
Indications of Movement of Structural Items on Slopes	None observed
Trespassing on Slopes	None observed
Sloughing or Erosion of Slopes or Abutments	None
Rock Slope Protection - Riprap Failures	Some sloughing of riprap on upstream slope near crest. Riprap missing in lower portion of slopes.
Unusual Movement or Cracking at or near Toes	None observed.
Unusual Embankment or Downstream Seepage	None observed.
Piping or Boils	None observed.
Foundation Drainage Features	None observed.
Toe Drains	None.
Instrumentation System	None
Vegetation	Small brush on downstream slopes.

PERIODIC INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Lake Harwinton Dam DATE: Nov. 15, 1979

AREA EVALUATED	CONDITIONS
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	Not visible (underwater)
a. Approach Channel	
Slope Conditions	
Bottom Conditions	
Rock Slides or Falls	
Log Boom	
Debris	
Condition of Concrete Lining	
Drains or Weep Holes	
b. Intake Structure	
Condition of Concrete	
Stop Logs and Slots	

PERIODIC INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Lake Harwinton Dam DATE: Nov. 15, 1979

AREA EVALUATED	CONDITIONS
OUTLET WORKS - CONTROL TOWER	
a. Concrete and Structural	None
General Condition	
Condition of Joints	
Spalling	
Visible Reinforcing	
Rusting or Staining of Concrete	
Any Seepage or Efflorescence	
Joint Alignment	
Unusual Seepage or Leaks in Gate Chamber	
Cracks	
Rusting or Corrosion of Steel	
b. Mechanical and Electrical	
Air Vents	
Float Wells	
Crane Hoist	
Elevator	
Hydraulic System	
Service Gates	
Emergency Gates	
Lightning Protection System	
Emergency Power System	
Wiring and Lighting System in Gate Chamber	

PERIODIC INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Lake Harwinton Dam DATE: Nov. 15, 1979

AREA EVALUATED	CONDITIONS
OUTLET WORKS - TRANSITION AND CONDUIT	
General Condition of Concrete	None.
Rust or Staining on Concrete	
Spalling	
Erosion or Cavitation	
Cracking	
Alignment of Monoliths	
Alignment of Joints	
Numbering of Monoliths	

PERIODIC INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Lake Harwinton Dam DATE: Nov. 15, 1979

AREA EVALUATED	CONDITIONS
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	
General Condition of Concrete	Not applicable
Rust or Staining	
Spalling	
Erosion or Cavitation	
Visible Reinforcing	
Any Seepage or Efflorescence	
Condition at Joints	
Drain Holes	None observed
Channel	Unlined
Loose Rock or Trees Overhanging Channel	None
Condition of Discharge Channel	Good

PERIODIC INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Lake Harwinton Dam DATE: Nov. 15, 1979

AREA EVALUATED	CONDITIONS
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	Good.
Loose Rock Overhanging Channel	None.
Trees Overhanging Channel	None.
Floor of Approach Channel	Unlined soil floor, no erosion evident.
b. Weir and Training Walls	
General Condition of Concrete	Fair condition, evidence of efflorescence and spalling noted.
Rust or Staining	None observed.
Spalling	Spalling noted on both right and left trainning walls and weir.
Any Visible Reinforcing	None observed.
Any Seepage or Efflorescence	Efflorescence noted.
Drain Holes	None observed.
c. Discharge Channel	
General Condition	Poor.
Loose Rock Overhanging Channel	None.
Trees Overhanging Channel	Several downstream.
Floor of Channel	Downstream end of concrete-lined section undermined by erosion.
Other Obstructions	Bedrock outcrop on left side of channel just downstream from concrete section apparently deflects flow towards right wall of channel causing severe erosion.

PERIODIC INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Lake Harwinton Dam DATE: Nov. 15, 1979

AREA EVALUATED	CONDITIONS
OUTLET WORKS - SERVICE BRIDGE	Concrete bridge over spillway appears to be in poor condition. Slab shows evidence of spalling and deterioration. This bridge carries vehicular traffic.
a. Superstructure	
Bearings	
Anchor Bolts	
Bridge Seat	
Longitudinal Members	
Under Side of Deck	
Secondary Bracing	
Deck	
Drainage System	
Railings	
Expansion Joints	
Paint	
b. Abutment & Piers	
General Condition of Concrete	
Alignment of Abutment	
Approach to Bridge	
Condition of Seat and Backwall	

APPENDIX B

ENGINEERING DATA

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Lake Harwinton Dam

I.D. NO. CT-00367

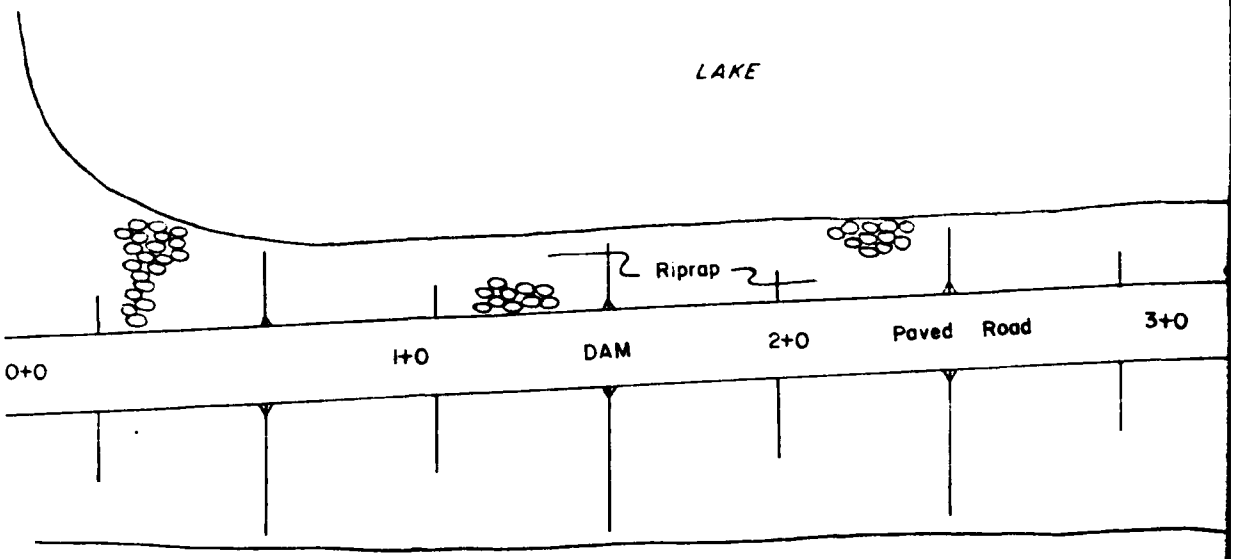
ITEM	REMARKS
AS-BUILT DRAWINGS	None Available
REGIONAL VICINITY MAP	Available from U.S.G.S.
CONSTRUCTION HISTORY	D.E.P. Files
TYPICAL SECTIONS OF DAM	Field Measurements (Reconstruction plans for Dike)
OUTLETS - Plan	Field Measurements
- Details	Field Measurements
- Constraints	Unknown
- Discharge Ratings	None available
RAINFALL/RESERVOIR RECORDS	Unavailable
DESIGN REPORTS	None
GEOLOGY REPORTS	None
DESIGN COMPUTATIONS	None
HYDROLOGY & HYDRAULICS	None
DAM STABILITY	None
SEEPAGE STUDIES	None
MATERIALS INVESTIGATIONS	None
BORINGS RECORDS	None
LABORATORY	None
FIELD	None

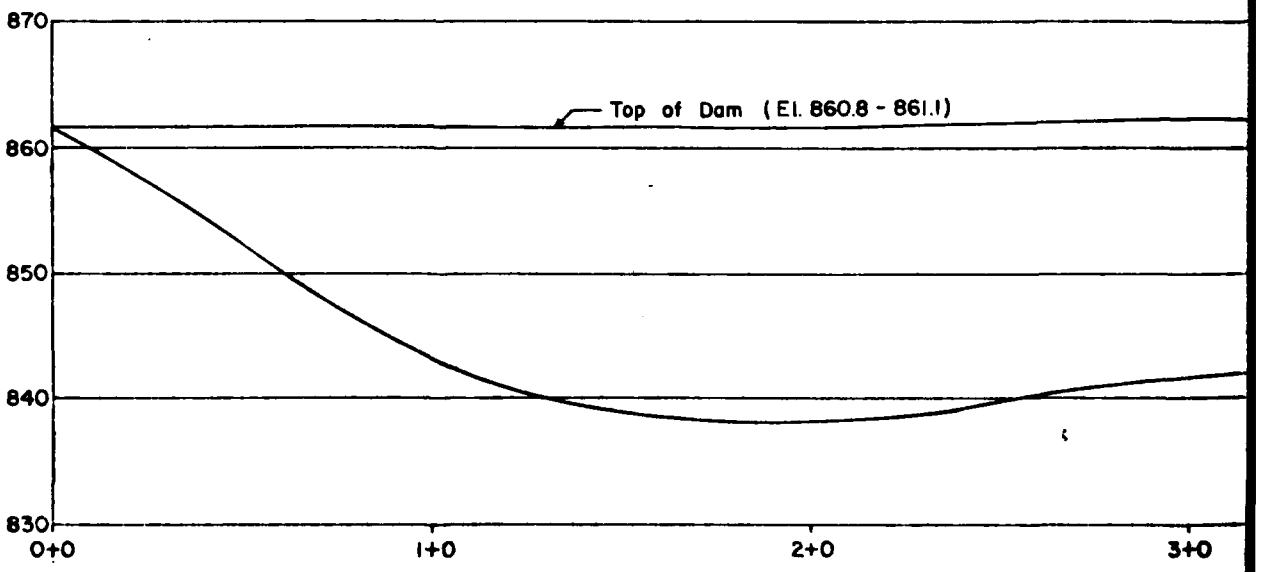
CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Lake Harwinton Dam

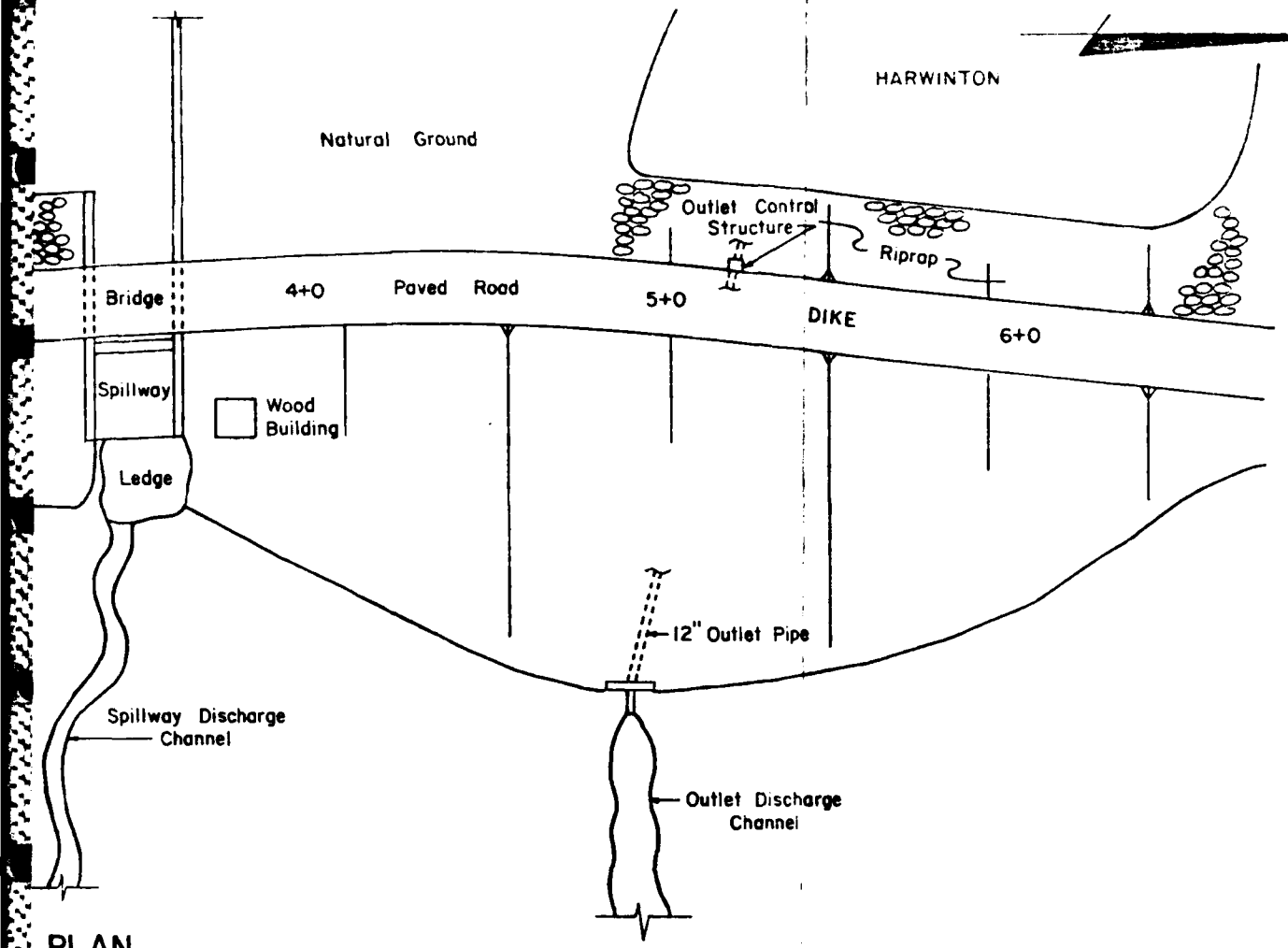
I.D. NO. CT 00367

ITEM	REMARKS
POST-CONSTRUCTION SURVEYS OF DAM	None Available
BORROW SOURCES	Unknown
MONITORING SYSTEMS	Unknown
MODIFICATIONS	Dike re-built (1969) Design by Kratzert and Jones
HIGH POOL RECORDS	None
POST-CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Unknown
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	Unknown
MAINTENANCE OPERATION RECORDS	Unavailable
SPILLWAY PLAN	
SECTIONS	Field Measurements
DETAILS	Field Measurements
OPERATING EQUIPMENT PLANS & DETAILS	Not available

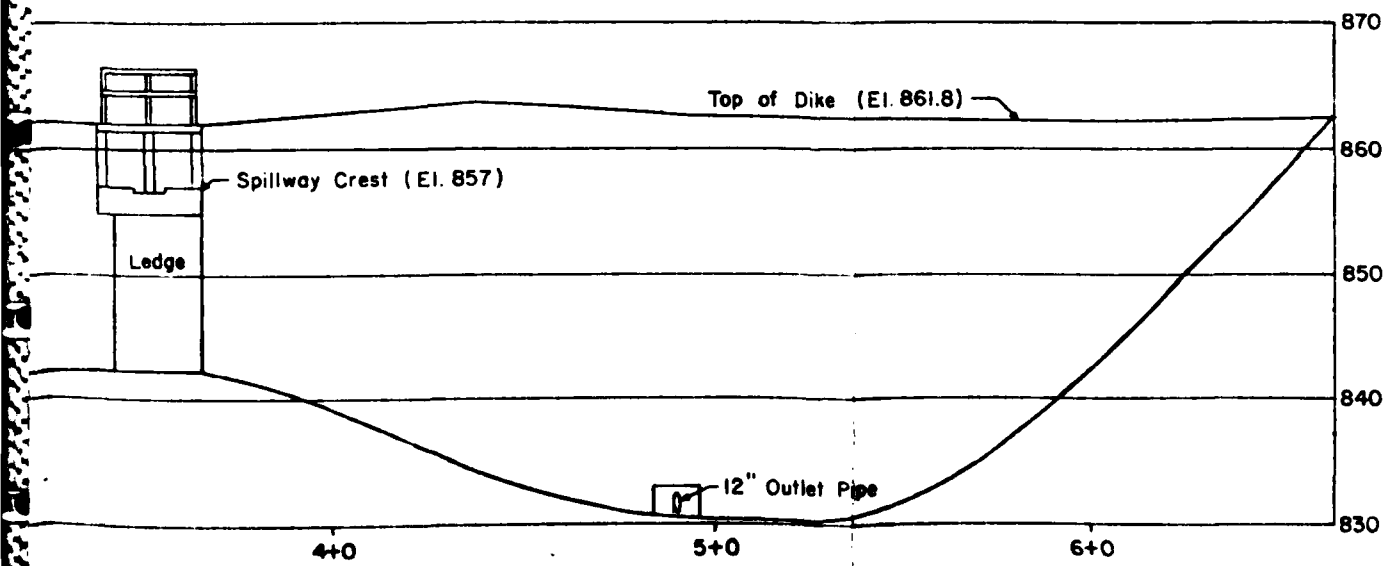

LAKE
Riprap
0+0
1+0
DAM
2+0
Paved Road
3+0


870
860
850
840
830
Top of Dam (El. 860.8 - 861.1)
0+0
1+0
2+0
3+0

* Datum : N.G.V.D

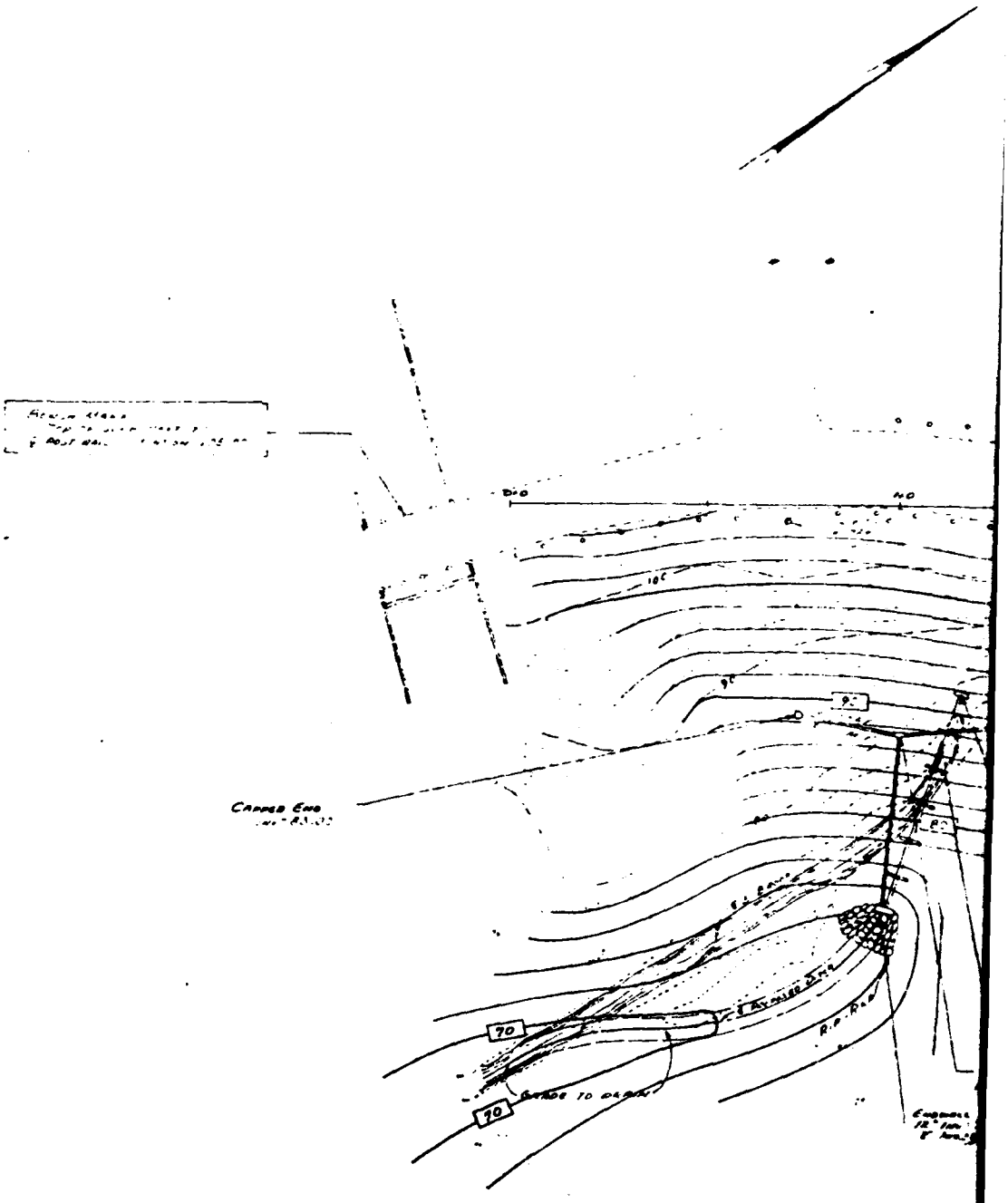


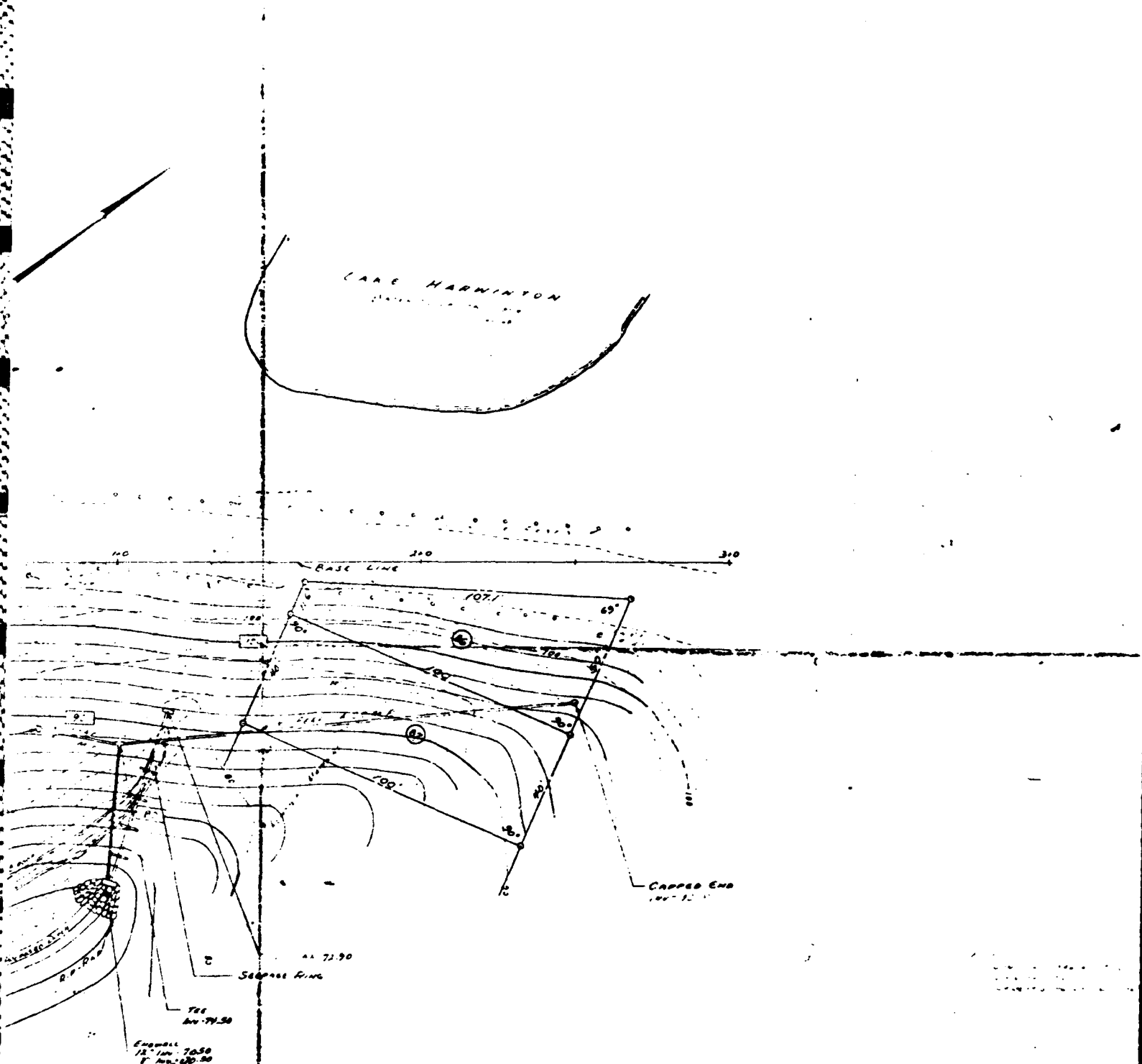
PLAN
NTS



PROFILE
NTS

LAKE HARWINTON DAM


70
70



NOTES
REMOVE EXISTING FILL PILE
SEE SPECIFICATIONS "SEEDING FOR EMBANKMENT"
PLACE 6" TOPSOIL AND SEED ALL SLOPES.

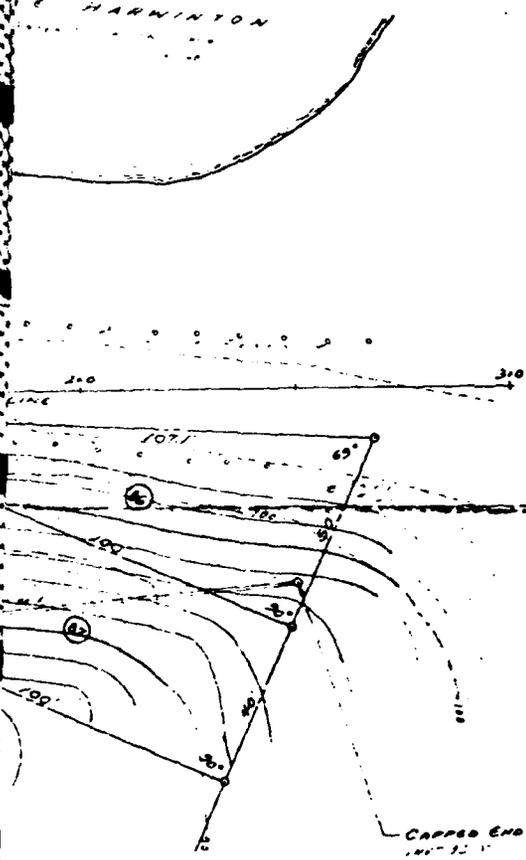
1 SET OF CATCH BASINS FOR ROADWAY DRAINAGE TO BE DESIGNED AND INSTALLED AT NORTH END OF NORTH DAM AND AT SOUTH END OF SOUTH DAM BY TOWN OF HARRINGTON

3 UNDER THIS CONTRACT SHOULDERS OF ROADWAY ON DAM TO BE GRADED SO AS TO PREVENT CONCENTRATED RUNOFF OF WATER.

HARRI

PATZE

3



NOTES

1. REMOVE EXISTING FILL DIKE
2. SEE SPECIFICATIONS SHEET NO. FOR EMBANKMENT)
3. PLACE 6" TOPSOIL AND SEED ALL SLOPES.

1 SET OF CATCH BASINS FOR ROADWAY DRAINAGE TO BE DESIGNED AND INSTALLED AT NORTH END OF NEW DAM AND AT SOUTH END OF SOUTH DAM BY TOWN OF HARWINTON CONTRACT SHOULDERS OF

3 UNDER THIS CONTRACT SHOULDERS OF ROADWAY ON DAMS TO BE GRADED SO AS TO PREVENT CONCENTRATED RUNOFF OF WATER.

2

PLAN SHOWING REPAIRS FOR

HARWINTON DAM

HARWINTON, CONNECTICUT

SCALE 1" = 20' JANUARY 1964

FRATZERT & JONES

REVISED - 6-3-64
REVISED - 5-7-64

3

R-4

Philip W. Genovese & Associates

June 30, 1958

REPORT TO
WATER RESOURCES COMMISSION
HARWINTON LAKE
HARWINTON - N 29.0 L 6.0 C 1.0

EXISTING CONDITIONS:

Harwinton Lake is approximately sixty acres in area and has a watershed of over five-hundred acres. It is located just west of Route No. 117 at a point one and one-quarter ($1\frac{1}{4}$) miles north of its junction with Route No. 116.

The area is generally steep, heavily wooded and, except for lakeside residences, sparsely developed. If the dam at this pond were to fail the primary damage would be to State highways 116 and 117 at their crossings of Catlin and Leadmine Brooks, respectively.

The dam is located at the southeast corner of the lake. An oiled gravel road has been constructed on top of the dam which serves as part of the lake road system. The overflow structure is a concrete Drop Spillway with an overall width of twenty-five (25) feet and a clear height (between the crest of the spillway and the underside of the bridge) of four (4) feet. Columns for the intermediate bridge pier are located along the center of the spillway, thereby reducing the capacity of the structure due to this additional entrance loss.

The low point of the roadway is five feet above normal water surface and a house, located within a hundred feet of the entrance to the spillway, which is at least ten feet above normal lake level.

Below the crest of the spillway is a concrete apron thirty to forty feet in length, on a fourteen percent grade. There is a fifteen foot drop from this apron to the steep, rugged stream channel below.

CONDITION OF STRUCTURE:

The earth dam and the concrete spillway appear sound. As noted in the photographs, there is some spalling of concrete on the apron and on the columns supporting the road slab over the spillway. There is also evidence of concrete

HARWINTON LAKE
HARWINTON - N 29.0 L 6.0 C 1.0

CONDITION OF STRUCTURE: (Cont.)

spalling on the wingwalls, both upstream and downstream from the overflow spillway.

HYDRAULIC ANALYSIS:

The storage capacity of the lake is more than adequate to impound the difference between the inflow from the peak runoff and the outflow through the spillway. This accumulation of inflow, minus outflow, can be discharged through the spillway within twelve hours after the termination of the storm.

Allowing a wave freeboard of 2.3 feet, the capacity of the spillway was computed to be 165 c.f.s. A design flow of slightly over 600 c.f.s. was used for the analysis at this site.

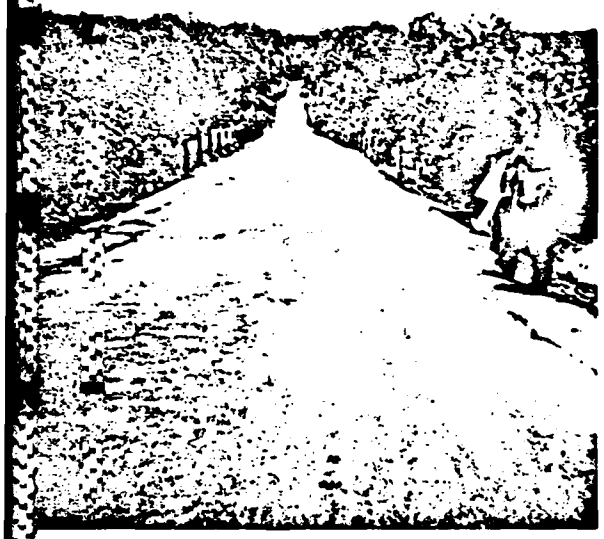
RECOMMENDATIONS:

The dam and spillway at this site are adequate hydraulically and structurally. There is sufficient storage capacity in the pond to handle the accumulation of runoff and the spillway is adequate to discharge this accumulation within a reasonable length of time after the storm.

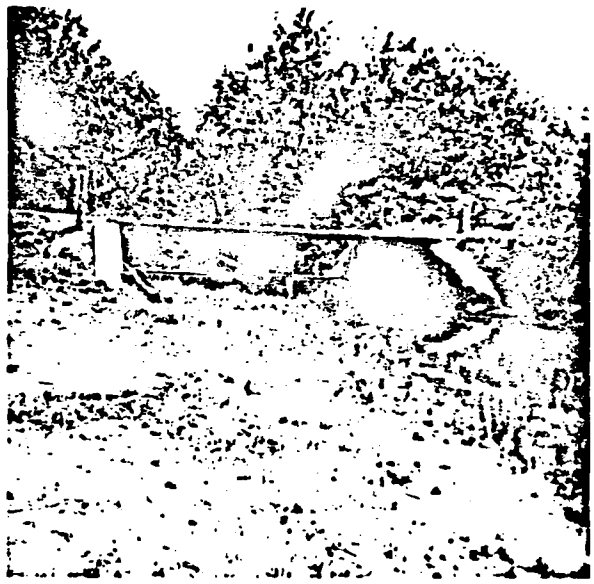
Patching of spalled concrete on the abutments, apron and wingwalls is required.

There does not appear to be a flooding problem at this site.

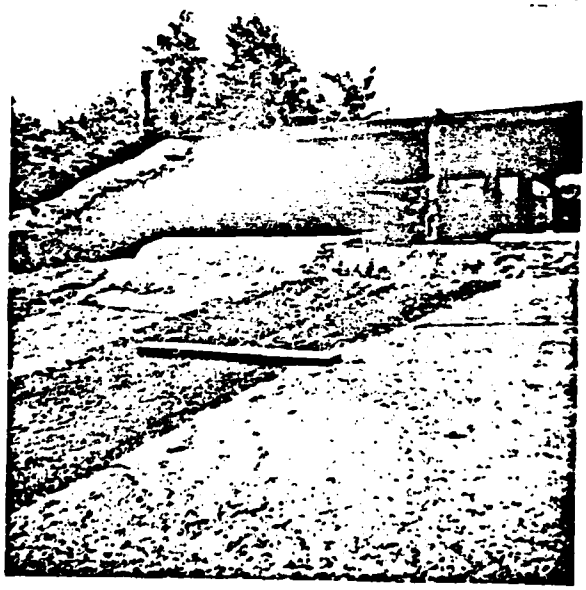
HARWINTON LAKE
HARWINTON - N 29.0 L 6.0 C 1.0



TOP OF DAM



SPILLWAY UPSTREAM
SIDE OF DAM



SPILLWAY DOWNSTREAM
SIDE OF DAM

JOHN J. MOZZOCHI AND ASSOCIATES
CIVIL ENGINEERS

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ECTOR L. GIOVANNINI

REPLY TO: Glastonbury

January 9, 1968

William H. O'Brien, III
Civil Engineer
Water Resources Commission
State Office Building
Hartford, Connecticut 06115

Re: Lake Harwinton Dam
Harwinton
OUR FILE NO. 57-73-84

Dear Mr. O'Brien:

On Saturday January 4, 1969 I visited the site to check the continued seepage at the weir (constructed October 9, 1968 by you) as reported to you by Mr. Wesley Rood.

The 12" discharge pipe was flowing substantially full and the surface of the lake ice showed an approximate drawdown of 9'±. Due to the snow cover on the downstream slope, it was not possible to evaluate the seepage condition at the weir and the lower portion of the embankment with any degree of accuracy. The area immediately downstream of the toe and Northeasterly of the drain pipe was covered with ice, indicating saturation of the snow cover.

Stability of the downstream slope is a factor which deserves consideration. With the drawdown of the lake in effect, the threat of a complete failure of the dam is remote. There does exist the possibility of a slide due to overloading of the slope at the top and the resultant undercutting at the toe. Material was dumped at the top to make a wider roadway and the slope was undercut to find the discharge pipe. In our previous investigation of the embankment, we found the safety factor of the slope to be 1.0±.

It is recommended some temporary work be done at the toe in the vicinity of the discharge pipe to prevent a slide. This should be done to protect the roadway (a town consideration). An extension of the pipe should be installed and the placing of pervious material where the slope was undercut. This will prevent a possible slide until the necessary corrective repairs are made to the entire embankment.

Very truly yours.

John Luchs, Jr. Associate

JL/ed

JOHN J. MOZZOCHI AND ASSOCIATES
CIVIL ENGINEERS

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REPLY TO Glastonbury

June 15, 1968

William H. O'Brien, III
Civil Engineer
Water Resources Commission
State Office Building
Hartford, Connecticut 06115

Re: Lake Harwinton Dam
Harwinton
OUR FILE NO. 57-73-84

Dear Mr. O'Brien:

On June 6, 1968 I inspected the site and found several items needing attention. In walking the donwstream toe of the embankment, I was unable to find the masonry endwall for the 12" R.C.P. drain at the Northerly dam as shown on the plan. I did find a concrete slab on the Westerly side of the road where the 14" valve and riser should be located. The observed and audible seepage appeared to be coming primarily from the general area where the drain endwall would be located.

I feel this drain has to be uncovered and checked for leakage as the required first step. With this information, the leakage problem can then be further evaluated. In view of this, the following recommendations are made:

1. Clean up the embankment area by removing the trees and undergrowth. The embankment should be open for quick visual checking.

2. Locate and expose the endwall for the 12" drain so leakage can be checked. This will require another visit after this has been done.

3. The existing storm water drain on the Easterly side of the road which flows from South to North and out falls on the downstream toe of the Southerly dam should be made a part of a closed drainage system. The outlet end should be constructed beyond the embankment to eliminate erosion. A similar situation exists at the Northerly end of the North dam and the road drainage should be picked up in a closed system and discharged beyond the toe of the embankment.

4. Storm water drainage should be provided on the roadway at the top of the North and South dams and discharged beyond the toe of the embankments or connected to a drainage system. Serious washouts have occurred at the top of the embankments (downstream side) and these have been partially filled by dumping fill in from the top.

5. The north and south concrete wing wall (East of the road) at the spillway is badly decomposed with reinforcing steel exposed. The wing walls should also be reconstructed to the height of the masonry walls immediately downstream.

Please inform me when the outlet drain has been uncovered and I will inspect the dam again.

Very truly yours,

John Luchs Jr.

John Luchs, Jr.
Associate

JL:ed

October 16, 1968

Memo to: File

From: William H. O'Brien III

Subject: Lake Harwinton Dam - Harwinton

On October 9, 1968, the undersigned and John Luchs, consultant to the Water Resources Commission inspected the subject dam. Also present were Mr. Wesley Rood, President of Lake Assoc., Mr. Shanley, town selectman, and a town labor force.

The water which was standing in the access "well" to the shut off valve on the upstream side of the dam was drawn down by a pump from the top some 17 feet to within about 8 feet of the bottom. The final pumping was quite slow (change of pumps) but they should be able to pump it dry by October 11th or 12th.

The valve was opened apparently fully, and water was allowed to flow out for approximately an hour or perhaps longer, clearing the downstream channel as it flowed out. During this time the water elevation below the dam was approximately level with the top of the 12" RCP drain pipe. The valve was then closed tightly and within minutes the flow through the pipe stopped.

Water was pumped from the pool below the dam to with 2" of the flow line of the pipe. A beam of sunlight was directed into the pipe by mirror and I could see in a straight line all the way to the shutoff valve. There was no indication of root growth penetrating the joints or of water seeping into the pipe from the joints, or elsewhere. The pipe appeared in near perfect alignment. WHO.

After the valve was closed, leakage continued through the downstream embankment, at several points. One leak was flowing out approximately 15 feet above the outlet pipe and some 15 feet north of the pipe. The flow through this one spot would approximate 1/2 gallon per minute. A make-shift V-notch metal weir was placed at this leak and the water was flowing through this weir approximately one inch deep, and the water level was marked on the inside of the weir. In three hours or more after the valve was closed, there was no noticeable change in the flow through this spot. The water was running clear.

It seems probable that the entire downstream embankment in this northerly dam is saturated to a minimum height of 15 feet above the outlet pipe. Flow of this volume emerging from several points rather than general seepage through this "rolled hard-pan" embankment would indicate some form of piping action through the dam probably from a crack or cracks in the core wall or possibly from cleavages in the ledge.

October 10, 1968 - John Luchs called and suggested we have the lake lowered. No answer in calling Mr. Rood's home. Called Mr. Shanley and spoke to him via his secretary and mobile radio. They had pumped out the valve access "well" to within one or two feet of the bottom and water was coming into the hole about 3 feet from the bottom. They were going to clean out the silt around the valve as well as possible and allow the hole to refill tonight. Mr. Shanley was told that we felt it was advisable to lower the lake over a period of the next few days until we could better determine what should be done. He agreed that this sounded like a good idea and was apparently going to follow through on this.

It was also suggested to Mr. Shanley that several stakes 3 or 4' long be driven vertically into the downstream embankment 2 or 3' deep at about 3 places in the excavated protion and a couple of places higher on the embankment. It w s requested that they observe these stakes 2 or three times a day to see if there was any deflection indicating a movement of the embankment. John Luchs is to inspect the site on Saturday, October 12, 1968.

October 10, 1968 - The undersigned called Mr. Rood, President of the Lake Assoc., (also 3rd selectman) at 9:00 P. M. at the town hall after their selectmen's meeting. He suggested that we hold a meeting with this association on Friday night at 8:00 P. M., October 11, to explain the reasons for requesting the draw down and the problems involved with the dam. I said I would attend. The valve was to be opened fully tommorow.

October 11, 1968 - Holiday - Called John Luchs who said he would attend meeting tonight. Found several references in text, "Earth and Earth-Rock Dams" which were pertinent to this dam. Mr. Rood called about 4:00 P. M. and said he could not get enough of the Assoc. together for a meeting tonight because of night school and men working nights and would we be able to attend a meeting on Sunday night, October 13th. I said I would attend.

October 12, 1968 - John Luchs inspected site. He found that the leak about 15 feet above the outlet pipe which we had placed a weir on had seemed to decrease somewhat judging from the water level and pencil mark on the inside.

October 13, 1968 - (Sunday night 8:00 P. M.) - John Luchs and undersigned attended a meeting at Mr. Roods house with about 13 members of the Lake Assoc. or board of directors. The plan of the dam was displayed and a description of the type of construction given, with a history of the findings and negotiations to date. The present condition of seepage was explained and what this meant in terms of the stability of the dam, and the probable cause of such leakage (a crack or cracks in the core wall - apparently in the vicinity of the outlet pipe). It was recommended that the water level be dropped 10 feet which would greatly stabilize the downstream embankment.

There followed a general discussion of possible remedial measures or repairs. The group was told that they should hire an engineer registered in the State of Connecticut to prepare plans for the repair of the dam. They appeared anxious to complete such work before winter and requested that we send them a list of engineers qualified to do this work. We explained that this work would require a major modification of the dam in stabilizing the downstream slope.

William H. O'Brien, III
Civil Engineer

WHOIII:vhb

10-17-68

October 23, 1968

Lake Harwinton Assoc., Inc.
c/o Mr. Wesley Rood, President
Catlin Road
Harwinton, Connecticut

Subj: Lake Harwinton Dam
Harwinton

Gentlemen:

According to the records in this office, the dam on Lake Harwinton is under your ownership.

Section 25-110 of the 1958 Revision of the General Statutes places under the jurisdiction of this Commission all dams, " . . which by breaking away or otherwise, might endanger life or property . ." The Commission finds that the failure of this dam would endanger life or property.

In accordance with Section 25-111 of the 1963 Supplement to the General Statutes, this dam has been inspected and was found to be in an unsafe condition. The statute states in part: "If after any inspection descrined herein, the Commission finds any such structure to be in an unsafe condition, it shall order the person, firm or corporation owning or having control thereof to place it in a safe condition or to remove it, and shall fix the time within which such order shall be carried out."

FINDING

Based on several inspections of the dam by our staff and by a consultant to this Commission, and itemized in memos to our file and a report to be forthcoming from our consultant, the Water Resources Commission finds the structure to be in an unsafe condition. It also finds that certain repairs or alterations are necessary to place the structure in a safe condition.

The repairs or alterations to be made should include but are not necessarily limited to the following items:

1. Stabilize the downstream embankment of the northern dike and/or stop the leaks through the dam.

2. Provide adequate disposal of storm water.

3. Maintain pond a minimum of 10 feet below normal pond. To provide a margin of safety against a sudden rise in the lake from a large storm, the lake should be lowered 13 to 15 feet below normal level.

ORDER

In accordance with Section 25-111 pf the General Statutes, you are hereby ordered to make the repairs or alterations necessary to place the structure in a safe category or to remove the structure.

Any repairs or alterations to the structure or its removal shall be carried out in accordance with engineering plans and specifications prepared by an engineer registered in the State of Connecticut and bearing his certification and seal. Such plans and specifications shall be submitted to this Commission for approval and for the issuance of a permit prior to any construction or demolition work in accordance with Section 25-112 of the General Statutes.

The Commission shall be notified within two weeks what steps you plan to take to repair or remove the structure. Item No. 1 of the work indicated shall be completed by December 15, 1968. Item No. 2 shall be completed by June 30, 1969.

Very truly yours,

John J. Curry
Director

JJC:vhb

Sent Certified Mail
Return Receipt requested

December 17, 1968

Memo to: File

From: William H. O'Brien III, Civil Engineer

Subject: Lake Harwinton Dam, Harwinton

On December 24, 1968, the undersigned received a call from a Mr. Thompson of Kratzert and Jones. He asked about the history of the seepage and I reviewed the file for him but found no mention of seepage prior to the May 7, 1968 field inspection.

They had located photographs of the original placing of the core wall which apparently showed a very poor bonding of wall to ledge. There was no key excavated for this wall, and apparently the pictures show concrete being poured onto mud and water with no ledge in evidence. The ledge that did show, apparently looked soft and fractured. It was their conclusion that most of the leakage was coming from between the wall and the ledge or, thru the ledge.

Plans are to be submitted the week after the first of the year.

William H. O'Brien III

Civil Engineer

WHO:jad

COPY

JOHN J. MOZZOCHI AND ASSOCIATES
CIVIL ENGINEERS

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ECTOR L. GIOVANNINI

Glastonbury
REPLY TO:

January 15, 1969

William H. O'Brien, III
Civil Engineer
Water Resources Commission
State Office Building
Hartford, Connecticut 06115

Re: Lake Harwinton Dam
Harwinton
OUR FILE NO. 57-73-84

Dear Mr. O'Brien:

Due to the serious nature of the seepage condition of the dam and the major corrective work required, the following resume (for your files) of my visits are listed below:

May 17, 1968 — Authorized to look at and report by Water Resources Commission.

June 6, 1968 — Visited site and sent in report dated June 15, 1968 with recommendations. It was observed that the original roadway on the top of the embankment had been wided to accomodate two way traffic by dumping fill on the slope. (This material took its natural slope (approximately 1:1) with the trailings rolling to the toe of the embankment and covering the endwall). The oiled surface road had been widened to 20' ± with guide posts placed from 1' ± to 10' ± off the edge of road.

In discussing my report with you, I indicated the necessity of uncovering the outlet pipe and checking the outlet valve to determine the possibility of a plugged outlet combined with a faulty valve forcing water through joints upward into the embankment.

July 24, 1968 — Visit to site arranged through Lloyd Shanley, Harwinton, 1st Selectman, to observe the uncovering of the endwall for 12" outlet drain by Town forces. Due to the wet condition of the downstream toe of the northerly dam, the tractor mounted backhoe was unable to get into position to uncover the endwall. The equipment was mired in saturated material and unable to move. Efforts made to locate the endwall with hand methods were unsuccessful due to the many stones that had rolled to the bottom of the slope when the roadway was widened. Upstream and downstream slopes of North dam had been cleared of trees and brush, and the upstream slope only of the

South dam was cleared. The trees on the upstream slopes were cut flush with the ground - the trees on the downstream slope were cut 2'± above the ground.

Seepage through the lower portion of the embankment (13'± above outlet water level) was obvious, with visual indication of piping taking place.

Left the site with the understanding bigger equipment would be hired to uncover the outlet pipe.

October 3, 1968 Visited site late afternoon as crane with clam bucket was leaving scene. Crane had reached out over the embankment from the top and had uncovered the outlet pipe. In so doing, the bucket had destroyed the endwall and several sections of the pipe. A 12'± x 12'± rupture, or excavation, of the embankment showed the embankment to be super saturated and "flowing". At your direction, the crane operator had placed available large stones around the outlet of the pipe on the embankment to stabilize the flow of the saturated soil.

The end section of the pipe (removed by clam bucket) was completely plugged with material that had apparently "backed up" into the pipe due to the dumped overburden on the slope.

Town personnel were able to open and close the valve. The end of the pipe was still submerged in the downstream pool and was unable to see the actual condition of flow from the pipe. I requested that a pump be made available for pumping out the downstream pool and the valve well. The valve well was filled with water to approximately the same elevation of lake.

The same general condition of seepage and piping prevailed as was evident on July 24th, with the disturbed area showing clearly the saturated condition of the embankment.

Left the site with the understanding a pump would be made available to check the outlet pipe for a valve leak. Also wanted to see what would happen in several days to the height of seepage or phreatic line after unplugging the discharge pipe.

October 9, 1968 Visited site to observe discharge pipe when valve well and downstream pool pumped free of water. Town personnel unable to draw down valve well due to depth and equipment on hand. Downstream pool pumped sufficiently to observe drain pipe with valve closed. Concluded valve was seating properly. Using a mirror, you checked the interior of pipe and reported the alignment was good with no root obstructions.

The condition of the embankment was comparable to previous visit, showing the super-saturated condition at the toe and in the disturbed area. You

fabricated a pool and weir arrangement to check the flow from the highest elevation (13'± above outlet) where piping was evident.

Left the site with the understanding the valve well would be pumped dry and I would revisit site on Saturday, October 12th.

October 10, 1968 After further consideration of the embankment condition and discussions with Mr. Pelletier of the Water Resources Commission, it was recommended to you that the lake level be lowered a minimum of 10' and a draw down be started immediately. You indicated you would so notify Lloyd Shanley, Harwinton 1st. Selectman and Wesley Rood, President of Lake Harwinton Association. Draw down started either Thursday night, October 10th or Friday morning, October 11th.

October 12, 1968 Visited site to check valve well and embankment conditions. Valve was open and discharging water with lake level down 1'±. Valve well still contained water and unable to check bottom and side conditions. Embankment condition was substantially the same, with the exception of a ¼" ± drop in the water surface elevation in the pool and weir arrangement constructed by you on October 9th. Placed four (4) "sticks" in saturated portion of embankment and plumbed by eye to check displacement.

Travelled to Harwinton Town Hall to discuss the serious nature of the problem with them and explain why I had recommended dropping the water level 10'±. Mr. Shanley showed me a photograph he had taken in the valve well which showed a leak (between joints of the boiler plate liner) under pressure forcing water in a thin film (jet) across the well. He indicated the leak was on the downstream side of the well.

Left with understanding I would be at Mr. Rood's home for a meeting of the Association directors on Sunday night, October 13, 1968.

October 13, 1968 Attended meeting at Mr. Rood's home (you were in attendance) with Directors of the Association to discuss problem and necessity of draw-down of Lake Harwinton. Presented resume of my visits to site and general conclusions. Spoke briefly to them of possible causes and possible solutions, and what steps they would have to take to correct situation. One director indicated he had measured an 18" drop in water level as of Sunday afternoon.

October 17, 1968 Visited site to check draw-down and embankment conditions. Water surface elevation down 3'± as checked on a dock post. The lower portion of the embankment was substantially the same with a minor amount of drying-out visible to the eye. The pool and weir arrangement constructed by you on October 9th was dry.

Vertical sticks placed on October 12th were still plumb to the eye, one

was missing.

As a result of these numerous visits, the following conclusions and recommendations are submitted.

General Conclusions:

1. Concrete core wall has failed in some unknown manner. Possible causes are:
   a) Wall has ruptured or cracked
   b) General deterioration of concrete. (The concrete walls of spillway were in poor condition and may be indication of concrete used on project).
   c) Loss of seal between core wall and ledge.

2. Embankment saturated and acting as a completely homogeneous dam. The leak in the valve well and the upper limit of seepage indicate this. The classic H/3 for the upper limit of seepage in a homogeneous dam on an impervious foundation is evident.

3. The stability of the downstream slope was anaylized and found marginal due to:
   a) Saturated condition of rolled hardpan embankment.
   b) Overloading top of slope to widen road.
   c) Undercutting toe to locate discharge pipe.

Recommendations:

1. Water level be dropped a minimum of ten (10) feet.
2. Create a modified zoned embankment type dam by adding a pervious blanket and drainage on the downstream side. (Repair of the core wall was considered. Due to the "unknown", causes and possible extensive work involved, it is more pratical, in my opinion, to preserve the integrity of the dam by the use of other corrective measures).
3. Check existing embankment with test pits for piping and removal of fines.
4. If there is any extended delay before repairs are started, temporary work should be done in the vicinity of the discharge pipe (downstream) to protect the existing slope from sliding.

Very truly yours,

JOHN J. MOZZOCHI AND ASSOCIATES

By _____
John Luchs, Jr., Associate

JL/ed

COPY

JOHN J. MOZZOCHI AND ASSOCIATES
CIVIL ENGINEERS

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JOHN J. MOZZOCHI
ASSOCIATES
OWEN J. WHITE
JOHN LUCHS, JR.
ECTOR L. GIOVANNINI

April 3, 1969

Glastonbury
REPLY TO:

STATE WATER RESOURCES COMMISSION
RECEIVED
APR 1969
ANSWERED
REFERRED
FILED

Arthur Kratzert
Kratzert & Jones
1457 Meriden-Waterbury Road
Mildale, Connecticut 06467

Subject: Lake Harwinton Dam
Harwinton

Dear Mr. Kratzert:

We have reviewed the plans and specifications as submitted and offer the following comments for your consideration as follows:

PLANS

1. Extend the 12" drawdown pipe in a straight line and at the same existing pitch. This will require some minor extra excavation but will reduce the pipe length by 20 ' ±.

2. Eliminate the paved ditch and use about 10' (length) of riprap on the sides and bottom of channel. Suggest 100# - 150# stone.

3. Eliminate manholes on the 6" underdrain.

4. Proposed underdrain would be very difficult to construct in the field. See possible alternate on sheet #3. Perforations to be up.

5. Provide small animal guard for outlet of 8" A.C.C.M.P.

6. Recommend reinforced concrete water pipe (pressure) with flexible joint. (See Lock Joint Interpace specification SP-25 for general type) for drawdown pipe.

7. Provision for topsoiling and seeding to provide vegetation cover on slope.

SPECIFICATIONS

1. Recommed specifying minimum concrete strength for collar,

April 29, 1969

Lake Harwinton Association
c/o Mr. Wesley Rood, President
Catlin Road
Harwinton, Connecticut

Subject: Lake Harwinton Dam
Harwinton

Dear Mr. Rood:

We received revised plans for the repair of the subject dam on April 22, 1969. On April 28, 1969 we received the comments of our consultant by phone, and wish to pass them on to you. You are advised that a Construction Permit cannot be issued for this work until the following comments have been complied with or resolved.

1. The manhole at the junction of the 6" underdrain and 8" ACCMP should be eliminated and replaced with a tee.

2. The animal guard in the 12" outlet pipe should be eliminated and the spacing enlarged on the 8" ACCMP.

3. The section between station 1 + 00 and 1 + 25 should be revised to fit the new conditions.

4. There should be some provision for top soiling and seeding the embankment to provide vegetal cover.

5. The suggestion of using the pipe trench as a test pit as proposed in a letter from Mr. David Thompson of Kratzert and Jones dated February 28, 1969 is satisfactory. However, the contractor must be prepared to make additional exploratory excavations with his equipment in the area of the upper leak through the dam north of the drawdown pipe. This excavation shall be done with out consultant and your engineer being present, and under their supervision.

6. Roadway drainage is not provided for in these plans.

7. The plans should include a notation on them that they are revised with the date of revision. Three sets of plans should be submitted without the stamp "Preliminary Plans - Not for construction". One copy will be returned to you stamped APPROVED when acceptable plans have been submitted.

8. Your consultant should send a written statement as to his conclusions and recommendations concerning the safety of the south dam.

This information had been requested in previous correspondence and in a meeting in this office. As soon as we receive revised plans and the requested supporting data, we will again consider issuing a Construction Permit.

Very truly yours,

Charles J. Pelletier
Division Engineer

CJP:O'B:b

CC: Kratzert & Jones
John Luchs

JOHN J. MOZZOCHI AND ASSOCIATES
CIVIL ENGINEERS

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~~JOHN J. MOZZOCHI~~
ASSOCIATES
OWEN J. WHITE
JOHN LUCHS, JR.
ECTOR L. GIOVANNINI

May 2, 1969

REPLY TO: Glastonbury

William H. O'Brien, III
Civil Engineer
Water Resources Commission
State Office Building
Hartford, Connecticut 06115

Re: Lake Harwinton Dam
57-73-84

Dear Bill:

For the record, I am submitting the same comments as I gave you by phone on April 28th.

1.) Eliminate manhole at Junction ~~over~~ of 6" U-drain and 8" A.C.C.M.P.
2.) The grid for the animal guard is too small-could plug. Only need on 8" A.C.C.M.P.
3.) Section between 1+0 and 1+25 should be revised to fit new any conditions.
4.) Some provision for top soil and seeding to provide vegetation cover.
5.) Soil testing on existing embankment still required.
6.) Roadway drainage not provided for.
7.) Any additional plans should not be marked preliminary and should have revised dates.

Very truly yours,

JOHN J. MOZZOCHI & ASSOCIATES

By John Luchs Jr.
John Luchs, Jr. Associate

JL/ed
File

JOHN J. MOZZOCHI AND ASSOCIATES
CIVIL ENGINEERS

GLASTONBURY, CONN. 06033
217 HEBRON AVENUE
PHONE 633-9401

PROVIDENCE, R. I. 02903
200 DYER STREET
PHONE GAspee 1-0420

JOHN J. MOZZOCHI
ASSOCIATES
OWEN J. WHITE
JOHN LUCHS, JR.
ECTOR L. GIOVANNINI

REPLY TO: Glastonbury

May 14, 1969

William H. O'Brien, III
Civil Engineer
Water Resources Commission
State Office Building
Hartford, Connecticut 06115

Re: Lake Harwinton Dam
Harwinton

Dear Mr. O'Brien:

We have reviewed the material as requested in your May 9th letter and make note of the following:

1. Base line for cross-sections should be shown on plan view for easy cross reference by a contractor.

2. Flow lines as shown on plan view are not in agreement with flow lines shown on profiles.

3. The 12" R.C.P. discharge pipe should be extended at the same pitch instead of using a vertical angle point. The underdrain pipe should be revised so the 8" outfall is at approximately the same elevation. All sheets should be adjusted to show this and be in agreement.

4. Section VI Pipe Construction of the specifications calls for mortar joints and plans call for rubber gasket.

It is recommended a construction permit be issued when these changes are incorporated.

The plans, specifications and the original letter are returned herewith as directed. Please note our suggestions for road drainage as annotated

in red on the plan sheets.

If this roadway drainage is constructed in general conformance with my suggestions, I feel the town could do the work without employing an engineer to prepare plans. It has to be stressed to the Town that the outfall pipe should be placed and the outfall channel protected to eliminate any possible danger to the embankment.

Very truly yours,

JOHN J. MOZZOCHI AND ASSOCIATES

By John Luchs Jr.
John Luchs, Jr.

JL/ed
encls: (3)
file

COPY

JOHN J. MOZZOCHI AND ASSOCIATES
CIVIL ENGINEERS

GLASTONBURY, CONN. 06033
217 HEBRON AVENUE
PHONE 633-9401

PROVIDENCE, R. I. 02903
198 DYER STREET
PHONE 421-0420

ASSOCIATES
JOHN LUCHS, JR.
ECTOR L. GIOVANNINI

REPLY TO: Glastonbury

June 2, 1969

William H. O'Brien, III
Civil Engineer
Water Resources Commission
State Office Building
Hartford, Connecticut 06115

Re: Lake Harwinton Dam
Final Plans Dated: 1/69
Revised: 5/1/69

Dear Mr. O'Brien;

We have reviewed the plans and find that our comments in our letter of May 14th, 1969 has been taken care of. Comment No. 4 deals with specifications and your latest submission does not have the specifications included.

It is recommended that a Construction Permit be issued with these plans after the specification item is taken care of. It is also pointed out that these plans contain no provisions for taking care of the roadway drainage.

If you have any questions, please call.

Very truly yours,

JOHN J. MOZZOCHI AND ASSOCIATES

By John Luchs Jr.
John Luchs, Jr. Associate

JL/ed
file

STATE OF CONNECTICUT

WATER RESOURCES COMMISSION

STATE OFFICE BUILDING • HARTFORD, CONNECTICUT 06115

June 6, 1969

CONSTRUCTION PERMIT FOR DAM

Lake Harwinton Association
c/o Mr. Wesley Rood, Pres.
Catlin Road
Harwinton, Connecticut

TOWN: Harwinton
RIVER: Leadmine Brook
TRIBUTARY: Catlin Brook

Gentlemen:

Your application for a permit to (repair) a dam on Catlin Brook known as Lake Harwinton Dam

in the Town of Harwinton in accordance with plans prepared by Kratzert & Jones dated Revised June 2, 1969 has been reviewed.

The construction, in accordance with those plans, is APPROVED under the conditions which follow.

I. The Commission shall be notified as follows:
   A. When construction is started.
   B. When the pipe is being laid.
   C. When construction per these plans is completed.
   D. When drainage construction by the town has been completed per note 1 on approved plans.

II. This permit with the plans and specifications must be kept at the site of the work and made available to the Commission at any time during the construction.

III. If any changes are contemplated or required, the Commission must be notified and supplementary approval obtained.

IV. If the construction authorized by this permit is not started within 3 months of the date of this permit and completed within 6 months of the date, this permit must be renewed.

V. Additional requirements -
   1. That the town will collect and safely divert the surface water reaching the extreme ends of the dam per note 1 on the plans and letter dated May 23, 1969 from Lloyd T. Shanley, Jr., 1st Selectman, Town of Harwinton.

Your attention is directed to Section 25-112 of the 1958 Revision of the General Statutes which states in part regarding this Construction Permit: "A copy of the permit shall be sent to the town clerk." The enclosed carbon copy of this permit is the copy intended for the town clerk and it is your obligation to duly file this copy.

Your attention is further directed to Section 25-115 of the 1958 Revision of the General Statutes - "Liability of Owner or Operator. Nothing in this chapter and no order, approval or advice of the Commission or a member thereof, shall relieve any owner or operator of such a structure from his legal duties, obligations and liabilities resulting from such ownership or operation. No action for damages sustained through the partial or total failure of any structure or its maintenance shall be brought or maintained against the state, a member of the Commission or the Commission, or its employees or agents, by reason of supervision of such structure exercised by the Commission under this chapter."

The Commission cannot convey or waive any property right in any lands of the State, nor is this permit to be construed as giving any property rights in real estate or material or any exclusive privileges, nor does it authorize any injury to private property or the invasion of private rights or any infringement of federal, state or local laws or regulations.

Your attention is also directed to Section 26-134 of the 1958 Revision of the General Statutes - "Obstructing Streams. No person shall, unless authorized by the director, prevent the passing of fish in any stream or through the outlet or inlet of any pond or stream by means of any rack, screen, weir or other obstruction or fail, within ten days after service upon him of a copy of an order issued by the director, to remove such obstruction." The address of the State Board of Fisheries and Game is State Office Building, Hartford, Connecticut.

Very truly yours,

WATER RESOURCES COMMISSION

John J. Curry, Director

JJC:O'B:vb

cc: Board of Fisheries and Game

SPECIFICATIONS REVISED 4-14-69

HARWINTON DAM-REPAIRS

I Unwatering

The Contractor shall construct and maintain all necessary channels and/or other temporary diversion and protective works; shall furnish all materials required therefor and shall furnish, install, maintain and operate all necessary pumping and other equipment for unwatering various parts of the work. After having served their purpose, all cofferdams and other temporary protective works shall be removed.

II Stripping for Embankment

The entire area on which the new embankment will be placed shall be stripped or excavated to a sufficient depth to remove all materials not suitable, as determined by the Engineer. The unsuitable materials to be removed shall include top soil, all rubbish, vegetable matter of every kind, roots, and all other perishable or objectionable materials which might interfere with the proper compacting of the materials in the embankment or be otherwise objectionable.

III Embankment Construction

The embankment shall be constructed to the lines and grades shown on the drawings. No brush, roots, sod or other perishable or unsuitable materials shall be placed in the embankment. The suitability of all materials for use in the embankment construction shall be determined by the Engineer. No material shall be placed in the embankment when either the material or embankment on which it would be placed is frozen.

The bank run gravel (as specified) shall be placed in the earth embankment in continuous layers not more than 6" in thickness after rolling. Tamping rollers having staggered uniformly spaced knobs and equipped with suitable cleaners shall be used for compacting the earth fill. The projected face area of each knob and the number and spacing of the knobs shall be such that the total weight in pounds of the roller and ballast distributed over the equivalent area of one row of knobs parallel to the axis, shall not be less than 250 lb/ in ^{2}.

EDWARD C. KRAWIECKI
ATTORNEY AND COUNSELLOR AT LAW
525 MAIN STREET
HARTFORD, CONNECTICUT 06103

September 22, 1969

State of Connecticut
Water Resources Commission
State Office Building
Hartford, Connecticut 06115

Re: Lake Harwinton Dam
Harwinton, Connecticut

Attention: Mr. William H. O'Brien, III, Civil Engineer

Gentlemen:

Please be advised that repair work on the dam will commence on or about September 25, 1969.

Pursuant to the contract between the Association and Anthony J. Cannavo, et al, d/b/a "Cannavo Gardens" of Winsted, Connecticut, at least 90 per cent construction is required within 30 days.

In the event that any problems should arise that can not be resolved on the site, I would be grateful to have you call me.

Very truly yours,

Edward C. Krawiecki

ECK/cap

TELEPHONE: 621-3638

File: Lake Harwinton Dam, Harwinton

KRATZERT AND JONES
CIVIL ENGINEERS · LAND SURVEYORS · SITE PLANNERS
1457 MERIDEN-WATERBURY ROAD · MILLDALE, CONN. 06467

October 8, 1969

STATE WATER RESOURCES COMMISSION
RECEIVED
OCT 15 1969
ANSWERED
REFERRED
FILED

Lake Harwinton Assoc.
C/O Mr. Wesley Rood, President
Catlin Rd.
Harwinton, Conn.

Dear Mr. Rood:

We met this day, with Mr. O'Brien of the "Water Resourses Commission", and Mr. John Luchs, for a field inspection of the initial dam repair work, inorder to check the soil condition (of the original embankment) and to advise the contractor on construction procedure.

The soil condition was basically as we had anticipated and designed for, a hard clay, fairly homogeneous, with isolated seepage in two or three locations. Since these areas of seepage (after stripping the unsuitable material) were a distance from the proposed reverse filter, it was advised by Mr. Luchs and agreed upon by all present to extend the stone filled area to better control and direct them into the reverse filter drain. For one particular seepage area which was suspected as being runoff from groundwater and was a greater distance and on the opposite side of the drain from the other areas, it was recommended that it be piped to the reverse filter because of the greater distance involved.

Ledge was found to exist in some areas where the pipe is being placed, and for this problem it was recommended that a pocket be chipped out of the ledge and some stone

TELEPHONE: 621-3638

KRATZERT AND JONES
CIVIL ENGINEERS · LAND SURVEYORS · SITE PLANNERS
1457 MERIDEN-WATERBURY ROAD · MILLDALE, CONN. 06467

placed before placing the reverse filter pipe. These changes in elevation and location will necessitate the drawing up of a new set of "as-builts", for future use.

The amount of unsuitable material found on the slopes, was far in excess of what we had guessed at, and as a result there will be a need for more bank run gravel than previously estimated.

All of the above items were not included in the original plans and will be additional cost items.

We will be checking the job periodically, keeping in touch with Mr. Canavo, and keeping you informed as construction proceeds.

Very truly yours,
KRATZERT & JONES

David P. Thompson
Assistant Engineer

FORM PUR STO 201

INTERDEPARTMENT MAIL

DATE: October 8, 1969

TO: File

DEPARTMENT:

FROM: William H. O'Brien, III, Civil Engineer

DEPARTMENT: Water Resources

SUBJECT: Lake Harwinton Dam, Harwinton

On october 6, 1969 the undersigned and John Luchs inspected the work in progress on the subject dam. David Thompson of Kratzert and Jones was there and the contractor Toni Canqvo.

Much surface material had been removed from the embankment north of the draw-down pipe, and gravel had been placed for a footing for the equipment. This was not porous enough for toe drain material and the contractor was instructed to remove it and place other gravel which was delivered to the site and was ok'd for this use.

The lower part of the embankment was very wet and small surface pipes were placed temporarily to handle the water seeping thru it. Gravel is to be placed directly against the excavated embankment as far back as conditions dictate its removal rather than rebuilding the embankment with "hardpan" to its present contour. A spring within the toe area is to be excavated somewhat and gravel placed in herring-bone fashion to drain it into the toe drain pipe. John Luchs is to return on Wednesday to observe pipe being laid.

W. H. O'Brien III

Civil Engineer

tvm

FORM PUR STO 201

INTERDEPARTMENT MAIL

DATE: May 11,1970

TO: File — DEPARTMENT: Water Resources Commission

FROM: William H. O'Brien III — DEPARTMENT: Water Resources Commission

SUBJECT: Lake Harwinton Dam - Harwinton

On May 6, 1970 the undersigned inspected the subject dam in the company of our Consultant, John Luchs, the owner's engineer, Dave Thompson of Kratzert and Jones, William Bloin, of the Lake Harwinton Association and Robert Kirkwood, First Selectman, Town of Harwinton, and Tony Cannavo, Contractor.

The lake was full with the water flowing over the spillway 2 or 3 inches deep. There was some flow from the concrete outlet pipe because the gate cannot be shut completely, there was also quite a bit of flow from the toe drain outlet pipe at the end wall at the toe of the dam. The town had nailed boards along the highway posts along side the road on the downstream side of the dam to prevent water from flowing over and eroding the downstream face. This was done as a temporary measure until catch basins or other means could be provided to control the drainage. The water, however, collected at low points and spilled over causing some erosion of downstream embankment. The overflow from what appears to be a natural spring at the north abutment of the dam flows along the toe of the dam and discharges near the end wall. This flow is augmented by the discharge of water along the northern groin line from a asphalt paved ditch. This flow will cause progressive erosion of the downstream toe unless it is moved away from the toe of the dam and stabilized.

It was agreed that the contractor, Tony ~~Graparotta~~ Cannavo, who was also at this inspection would do some additional seeding and filling in of small gullies on the downstream slope. The First Selectman was to bring up at a budget meeting on the 19th the necessary repairs to this dam and the provision of adequate drainage. It is assumed that money would be provided for this purpose in compliance with previous agreements of the town. And that work on this drainage system would begin this summer and consist of:

Installing catch basins and connecting pipe at both the north and south of the dam and the relocation of the drainage ditch along the toe of the dam at the north end away from the toe of the dam. The trees along the toe of the southern dike should also be cut for at least 20 feet out from the toe.

W.H.O'Brien III

William H. O'Brien III
Civil Engineer

WHOIII/lch

MOZZOCHI ASSOCIATES
CIVIL ENGINEERS

GLASTONBURY, CONN. 06033
217 HEBRON AVENUE
PHONE 633-9401

PROVIDENCE, R. I. 02903
169 WEYBOSSET STREET
PHONE 421-0420

PARTNERS
JOHN LUCHS, JR.
STUART J. BECKERMAN

REPLY TO: Glastonbury

May 12, 1970

William H. O'Brien, III
Civil Engineer
Water Resources Commission
State Office Building
Hartford, Connecticut 06115

Re: Lake Harwinton Dam
Our File #57-73-84
Final Inspection Report

Dear Mr. O'Brien:

A final inspection was held on May 6, 1970 at the site with the following in attendance:

William H. O'Brien, III - Water Resources Commission
David P. Thompson, - Kratzert & Jones
Robert Kirkwood, - 1st Selectman, Town of Harwinton
William Blouin, - Lake Harwinton Association
Anthony Cannaro, - Contractor
John Luchs, Jr. - Mozzochi Associates

Reference is made to my letter to you dated June 15, 1968 in which five (5) items were noted. Following in the same order, the final inspection showed the following:

1. Due to the repair construction on the northerly embankment, the problem of trees and undergrowth has been taken care of. The southerly portion of the dam (embankment) still has to be cleaned up. This requires the cutting of trees and undergrowth for quick visual inspection of the slope.

2. This item taken care of with the construction required to repair the Northerly embankment.

3. Has not been corrected. During meetings with the Lake Harwinton Association and the Town of Harwinton, and previous correspondence, this was repeatedly mentioned as an item of work to be done. It is my understanding that the Town and the Association had an agreement between themselves to provide for the storm water drainage.

4. Same comment as number 3.

5. This work has been completed.

With respect to items 3 & 4 as listed above, the surface water that flows southerly on the northerly portion of the dam is now directed to the toe of the embankment by paved ditches. It continues to flow in the vee created by the embankment and the natural ground until it falls into the brook at the endwall for the drawdown pipe. This is creating an erosion problem along the toe of the embankment. At approximately Sta. 2+25 (see plans for base lines), a low point in the road surface collects the water and directs it down the slope in a concentrated flow. Again, this has created an erosion problem on the downstream toe of the embankment.

In my opinion, the erosion problems mentioned are not the responsibility of the Lake Harwinton Association but more rightfully belong to the Town of Harwinton. It is recommended that closed drainage systems be installed on both embankments as soon as possible to prevent any further problems. With respect to the northerly embankment, it is further recommended that the eroded trough on the embankment (Sta. 2+25+) be filled in and reseeded. Also, a swale should be created in virgin soil 10'-15' easterly (away from) the present eroded area at the toe of the embankment.

The working agreement, between the Association and the Town, whatever it may be, seems to confuse the issue of responsibility for the storm water drainage. In my approval of the original construction plans for the repair work, it was noted on several occasion that no provision was made for constructing the storm system. In each instance I was assured that this work would be done at a later date through the corporation of the Town.

In observing the growth of grass in the new construction area, it was evident that the seed placed last fall had not germinated. This was discussed with the contractor and he will reseed the entire embankment. This should be observed at a later date to determine if the stand of grass is sufficient to protect the embankment.

In summary, I would recommend an additional visit to the site to check the growth before authorizing a Certificate of Approval for the repair work done to date. There still remains additional work to be done on this dam.

Very truly yours,

MOZZOCHI ASSOCIATES

By John Luchs, Jr., P.E.

JL/ed
file

Lake Harwinton Association, Inc.
R.F.D. 3 HARWINTON, CONNECTICUT

February 8, 1971

Water Resources Commission
State Office Building
Hartford, Connecticut

RE: Lake Harwinton Dam
Harwinton, Conn.

Dear Mr. O'Brien,

Regarding your letter of January 22, 1971 - To the best of our knowledge, the drainage situation at the dam has been corrected to your recommendations.

On August 25, 1970, three representatives from the Board of Governors met with First Selectman Robert Kirkwood at the dam site. Your recommendations and those of Cannavo Gardens were followed as far as laying of curbing and "hardtopping" of surface drains down the back side of the dam.

It was our understanding that your Commission was notified of the completion of this work. If you did not receive notice of this, the letter must have gotten lost somewhere.

Inspection of this area at the present time, for all practical purposes, is impossible due to the snow cover. It can be seen from the absence of ice conditions on the roadway that the drains must be in the right place to keep the road clear of puddles.

We would appreciate notice if and when you wish to inspect this area so that we could have someone from the board there in case of questions or furthur recommendations.

Yours truly,

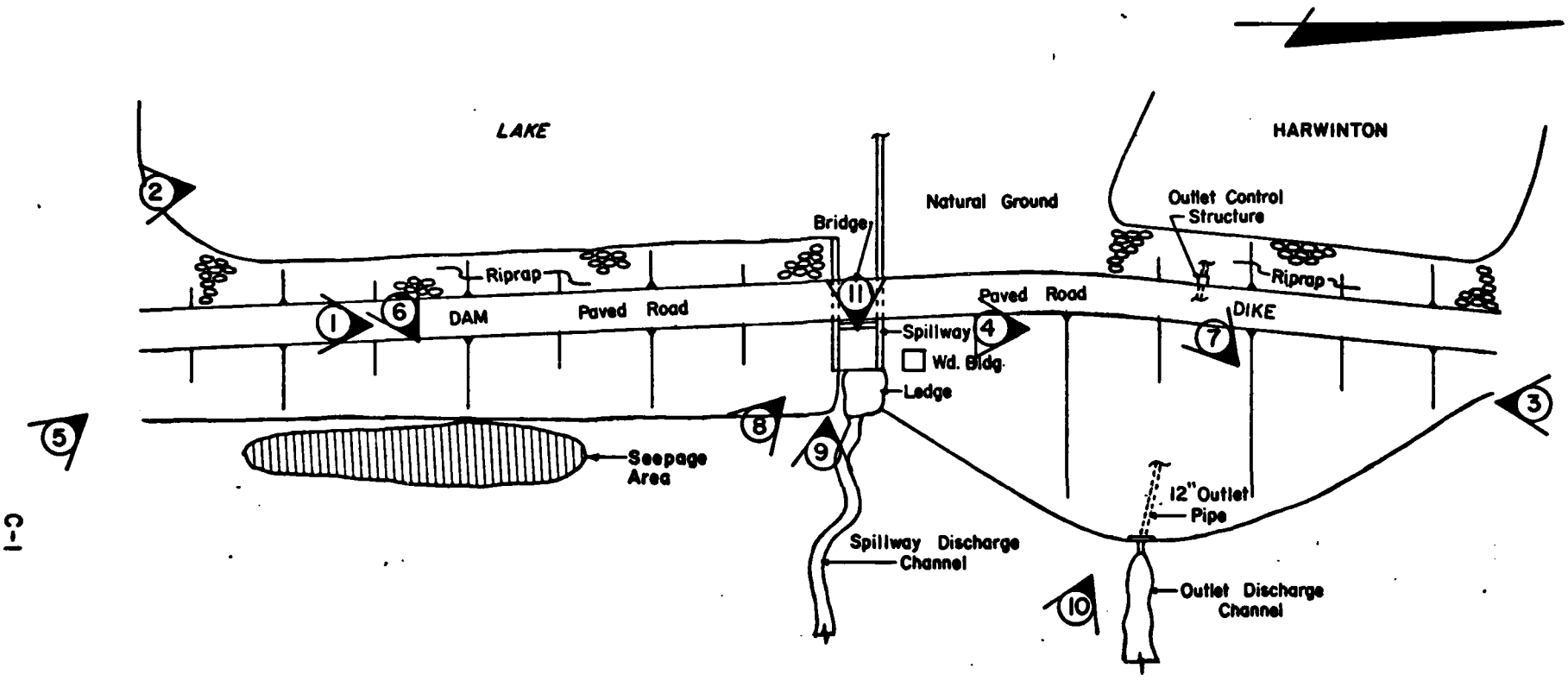
John Bendoraitis

John Bendoraitis
Secretary-treasurer
Lake Harwinton Assoc.

STATE WATER RESOURCES COMMISSION
RECEIVED
FEB 10 1971
ANSWERED
REFERRED
FILED

APPENDIX C

PHOTOGRAPHS



C-1

LEGEND

(5) Number refers to caption. Arrow indicates direction of photograph.

LAKE HARWINTON DAM
PHOTO LOCATION MAP

PHOTO #1: Crest of dam looking toward left abutment

PHOTO #2: Upstream face of dam looking toward left abutment

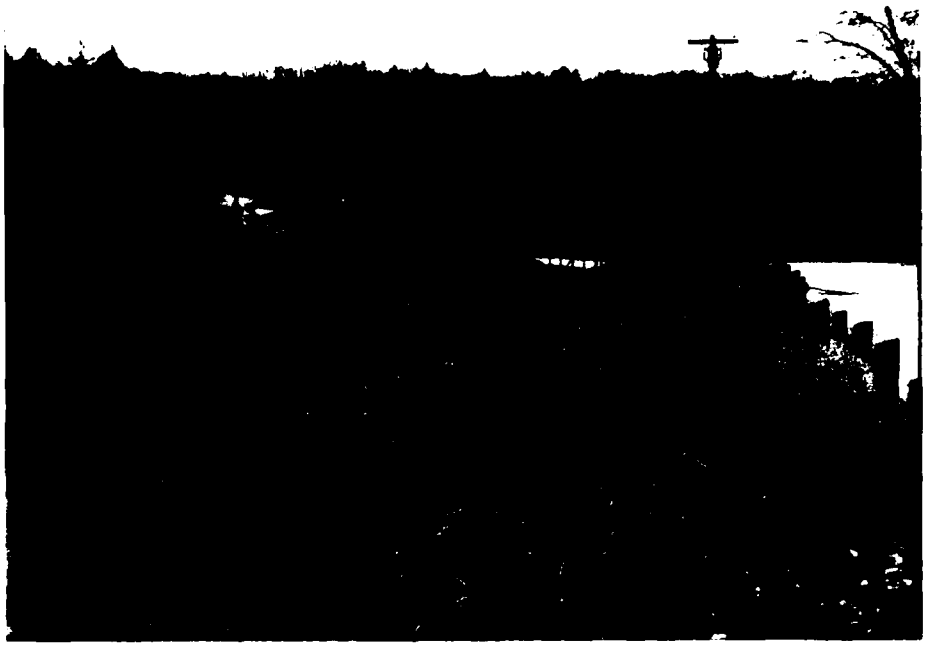


PHOTO #3: Downstream slope of dam and dike looing toward right abutment

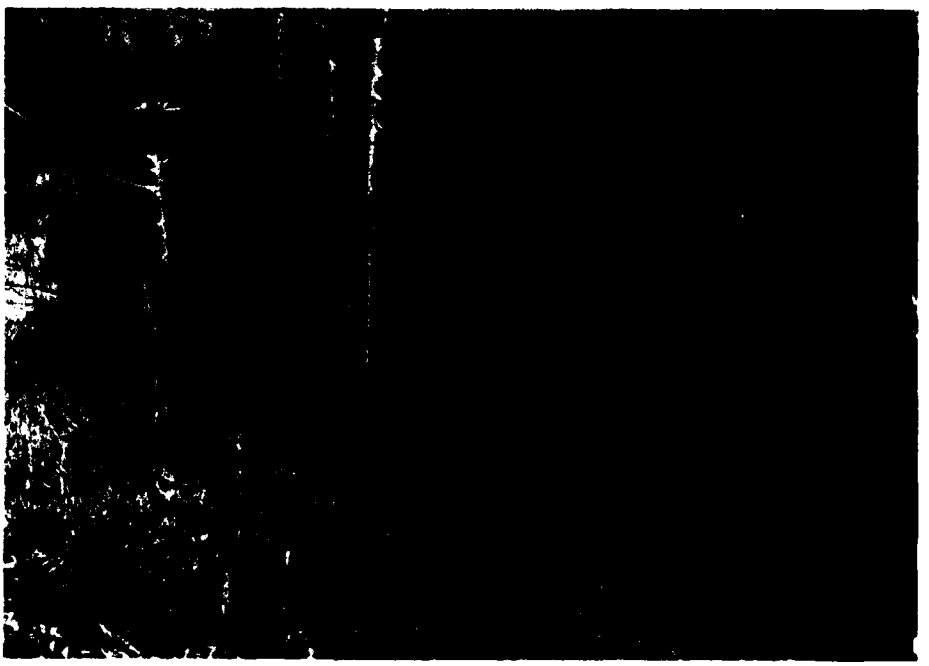


PHOTO #4: Downstream slope of dike from spillway

PHOTO #5: Twenty-one inch diameter culvert discharging onto downstream slope near right abutment

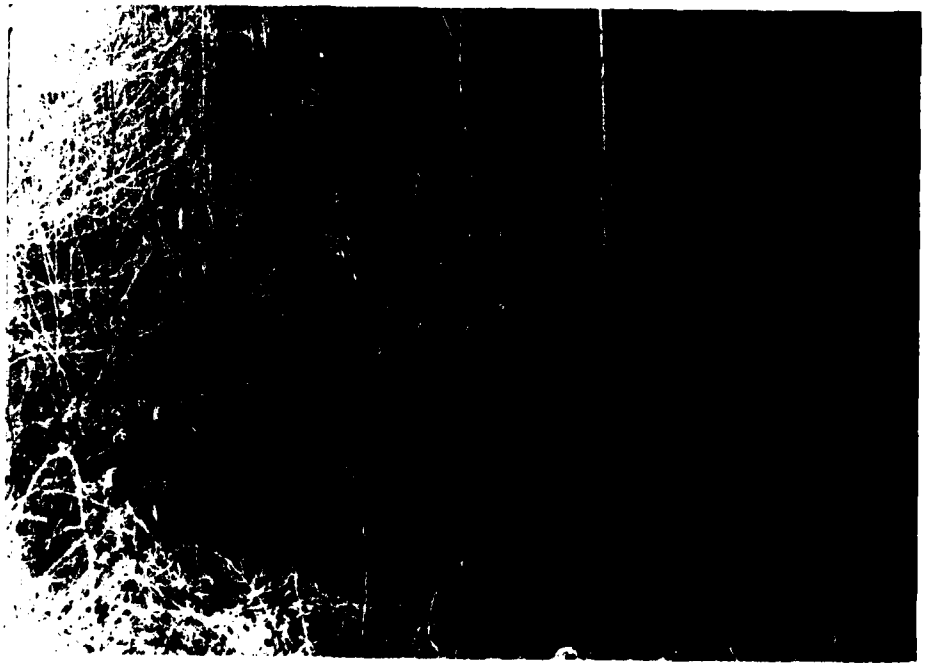


PHOTO #6: Large area of standing water near downstream toe of dam, looking downstream from the crest

PHOTO #7: Downstream slope of dike looking toward left toe

PHOTO #8: Spillway from downstream

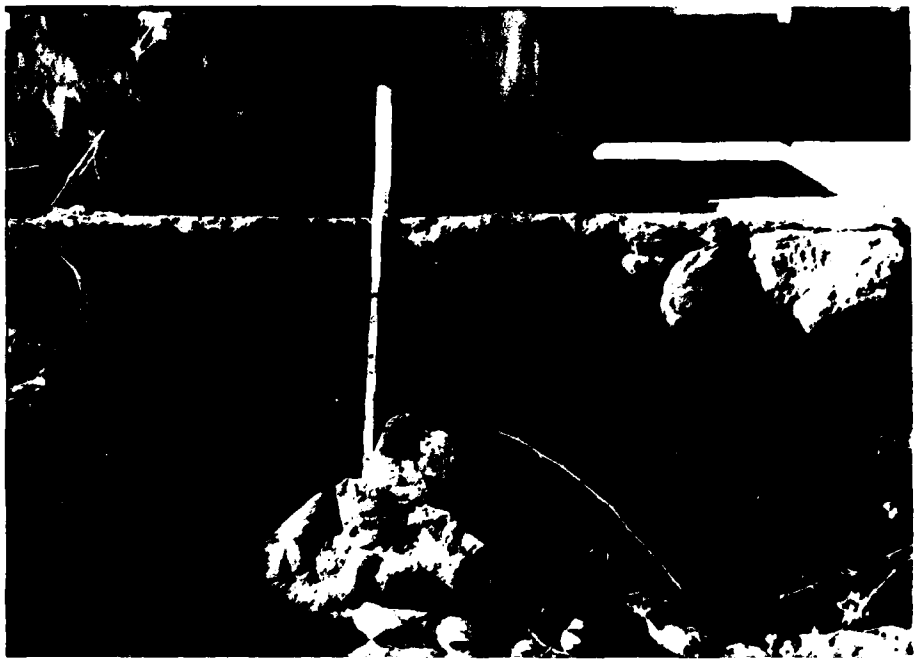


PHOTO #9: Erosion beneath the downstream end of the concrete floor of the spillway discharge channel

PHOTO #10: Blow-off during operation

PHOTO #11: Downstream spillway channel

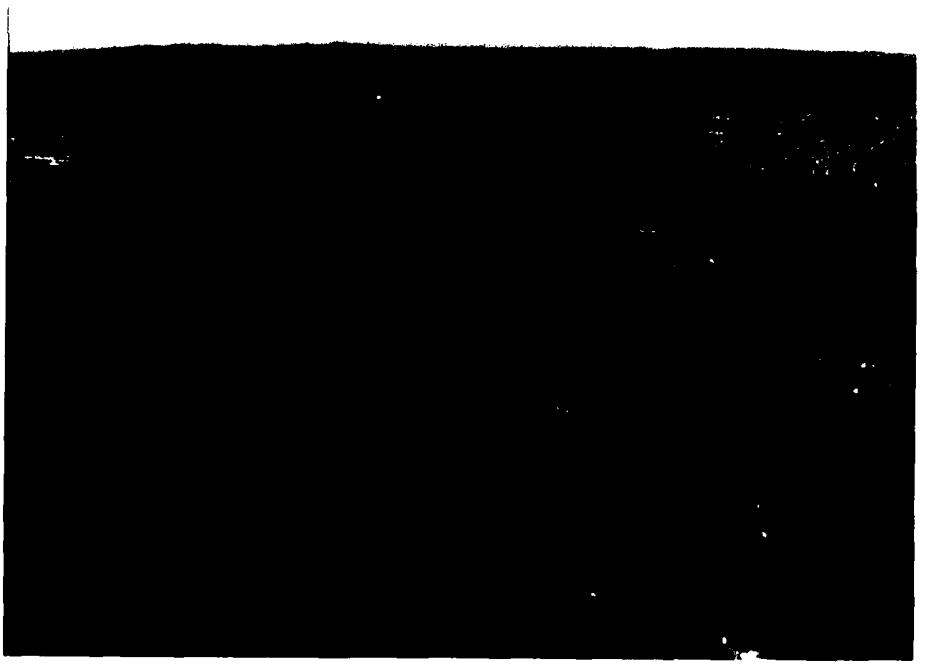


PHOTO #12: Reservoir Area

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

THE PMP RAINFALL IS 24 INCHES FOR A 6 HOUR DURATION STORM. USING A 20% FACTOR FOR IMPERFECT FIT THE EFFECTIVE RAINFALL IS 19.2 INCHES (FIG. 15, PAGE 48, DESIGN OF SMALL DAMS)

PMP 1 HOUR FIG. 18, PG 51

$(.5)(19.2) = 9.6$ IN

PMP 24 HOUR FIG 16, PG 49

$(1.2)(19.2) = 23.04$ IN

RUNOFF

USING AN ASSUMED CN VALUE OF 80 FOR GLACIAL TILL SOILS, THE RUNOFFS IN INCHES ARE: (FIG. A-4, PG 512, DESIGN OF SMALL DAMS)

1 HOUR RAINFALL = 9.6 INCHES → RUNOFF = 7.1 INCHES

6 HOUR RAINFALL = 19.2 INCHES → RUNOFF = 16.5 INCHES

24 HOUR RAINFALL = 23.04 INCHES → RUNOFF = 20.0 INCHES

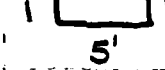
TIME OF CONCENTRATION

OVERLAND FLOW

$S = \frac{150'}{1300'}$ 11.5% $V = 0.90$ FT/SEC $= \frac{1300}{0.90 \text{ ft/sec}} = 1444$ SEC

L=1700 $S = \frac{10}{1700} = 0.6\%$ $V = .37$ FT/SEC $= \frac{1700 \text{ ft}}{.37 \text{ ft/sec}} = 4595$ SEC

APPROX CHANNEL =



$V = \frac{1.49}{n} R_h^{2/3} S^{1/2}$

$V = \frac{1.49}{n} (.714)^{2/3} (.029)^{1/2}$

$= 5.1 \text{ FT/Sec}$

$A = 5 \text{ FT}^2$

$R = 5/7 = .714$

$S = 33/1150 = .029$

$\frac{1150 \text{ ft}}{5.1 \text{ FT/Sec}} = 225 \text{ Sec}$

TOTAL # OF SEC = 6,264 Sec $= \frac{1 \text{ hr}}{60^2 \text{ Sec}} = 1.74$ HOURS

$T_C = 1.74$ HOURS

½ PROBABLE MAXIMUM FLOOD

$Q = \frac{484 AR}{T_P}$ $T_P = D/2 + .6T_C$ $A = 0.76$

Q 1 HOUR

$T_P = ½ + (.6)(1.74) = 1.54$ HOURS SAY 1.5 HOURS

$Q = \frac{484 (.76)(7.1)}{1.5} = 1741 \text{ CFS } (.5) = 871 \text{ CFS}$

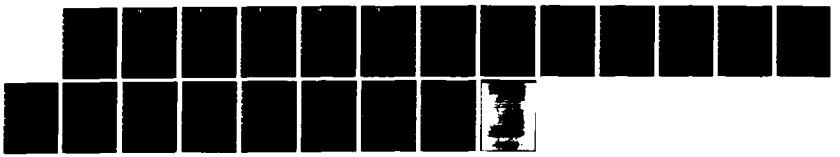
VOLUME OF RUNOFF

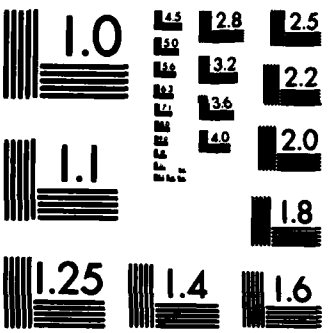
24 HOUR STORM

$(.5)\left(\frac{29.0 \text{ IN}}{12 \text{ IN/FT}}\right)(.76 \text{ mi}^2)(640 \text{ AC/mi}^2) = 405.3 \text{ AC-FT}$

AD-A143 982 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS 2/2
LAKE HARWINTON DAM (C.. (U) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV MAY 80

UNCLASSIFIED F/G 13/13 NL

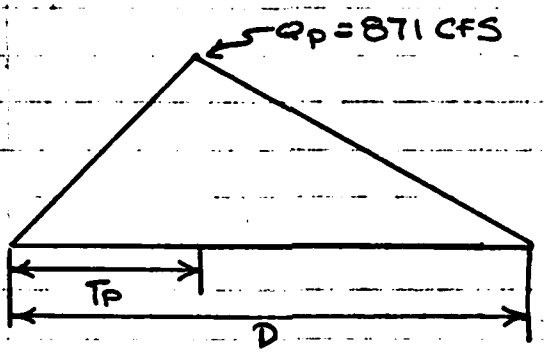




FLAHERTY-GIAVARA ASSOCIATES
ENVIRONMENTAL DESIGN CONSULTANTS
ONE COLUMBUS PLAZA, NEW HAVEN, CONN. 06510/203/789-1260

HYDROGRAPHS

A TRIANGULAR HYDROGRAPH IS TO BE USED FOR THE ROUTING OF THE TEST FLOOD THROUGH THE RESERVOIR, PEAK FLOW EQUALS 871 CFS, SET DURATION OF RUNOFF SO AS TO CONTAIN VOLUME OF RUNOFF. THE RECEEDING LIMB EQUALS TWICE THE RISING LIMB



$$Vol = \tfrac{1}{2} Q_p D$$

$$405 = \tfrac{1}{2}(871) D$$

$$D = \frac{(405 \text{ AC-FT})(43560 \text{ FT}^2/\text{AC})}{0.5(871 \text{ CFS}) \times 60 \text{ MIN/HR} \times 60 \text{ SEC/HR}} = 11.3 \text{ hours}$$

SAY $T_p = 3.7$ HOURS

$D = 11.3$ HOURS

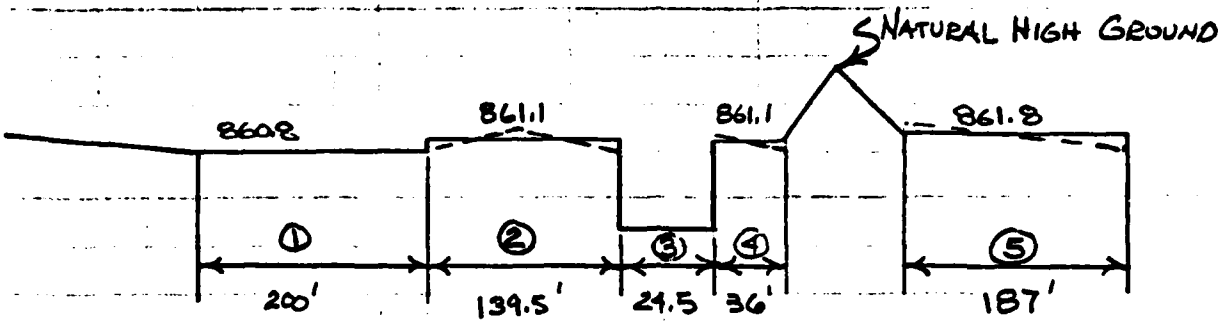
FLAHERTY-GIAVARA ASSOCIATES
ENVIRONMENTAL DESIGN CONSULTANTS
ONE COLUMBUS PLAZA, NEW HAVEN, CONN. 06510/203/789-1260

Q_p = 871 CFS
D = 11.3 HRS
T_p = 3.7 HRS

TIME (HOUR)	INFLOW (CFS)
0	0
1	235
2	470
3	706
3.7	871
4	837
5	722
6	608
7	493
8	378
9	263
10	149
11	34
11.3	0

FLAHERTY-GIAVARA ASSOCIATES
ENVIRONMENTAL DESIGN CONSULTANTS
ONE COLUMBUS PLAZA, NEW HAVEN, CONN. 06510/203/789-1260

SPILLWAY AND OVERFLOW SECTION N.T.S.



NOTE: DAM CREST ELEVATIONS OBTAINED IN FIELD FROM SURVEY MEASUREMENTS

SEGMENT	ITEM	C	LENGTH	ELEVATION
1	PAVED ROAD W/ GRASS & BRUSH BANKS	2.5	200'	860.80
2	"	2.5	139.5	861.10
3	CONC SPILLWAY	3.0	24.5	857.0 (FROM USGS TOPOGRAPHIC MAP)
4	PAVED ROAD W/ GRASS AND BRUSH BANKS	2.5	36'	861.10
5	"	2.5	187'	861.80

IE = 857 IV = 0
E = 857 A = 33.1 ACRES
E = 870 A = 71.6 ACRES

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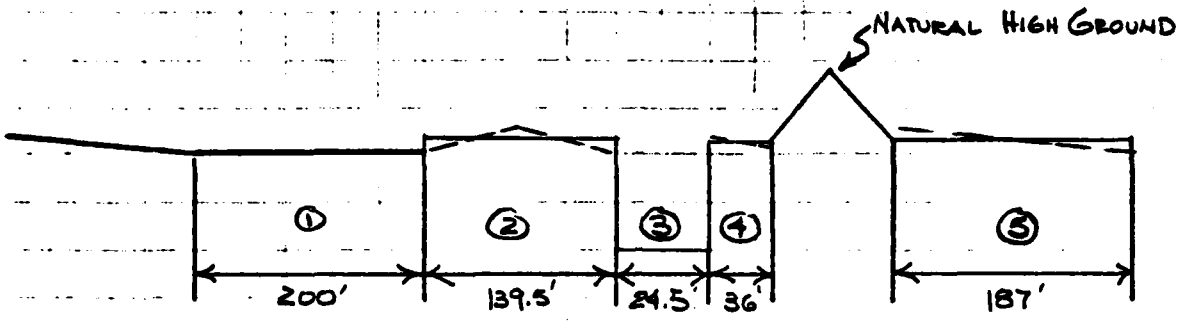
STAGE DISCHARGE DATA

N.T.S.



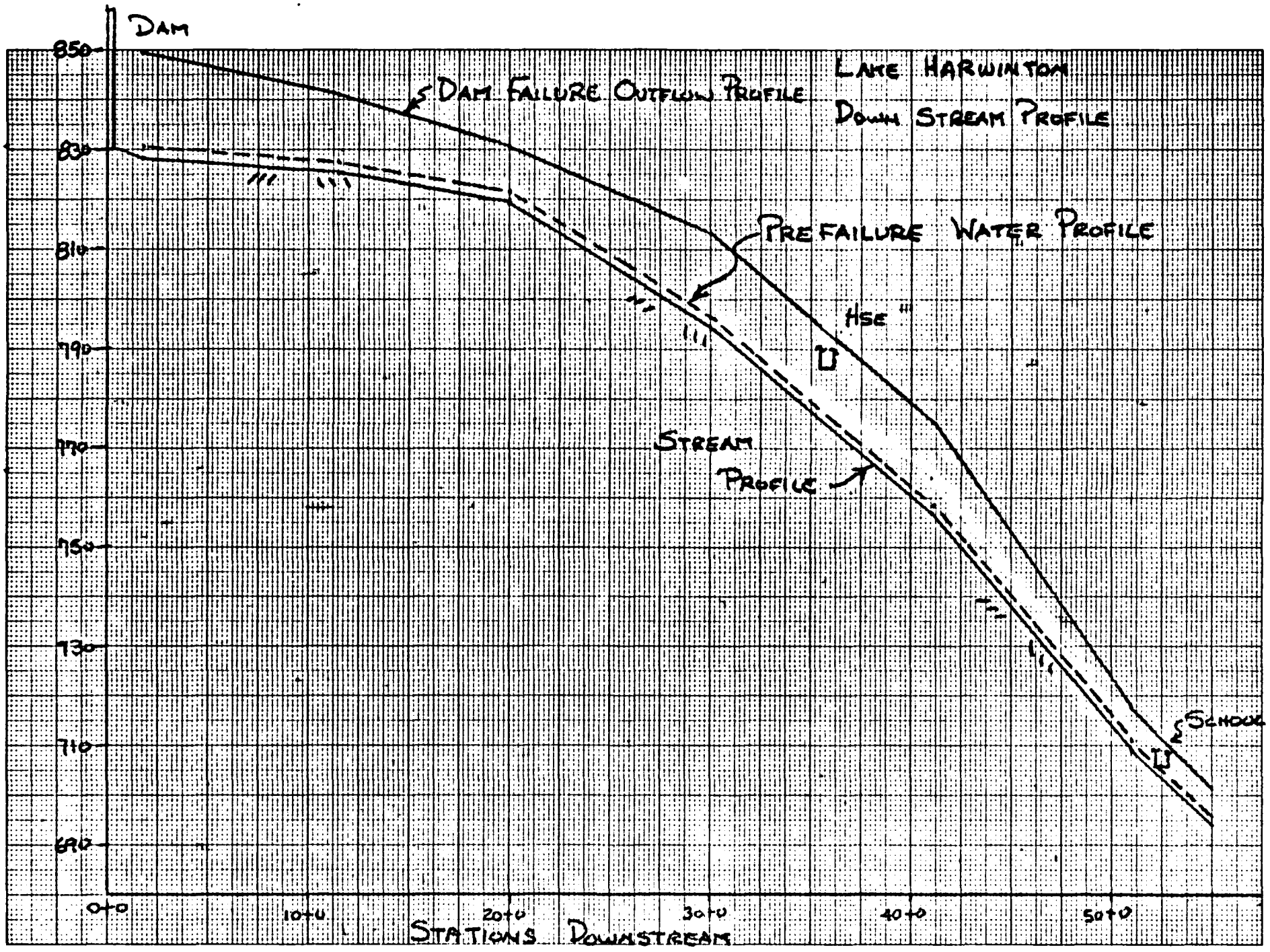
ELEVATION =	857	858	859	860.8	861.1	861.8	862	863
$Q_1=(2.5)(200)H^{1.5}$				—	82	500	657	1632
$Q_2=(2.5)(139.5)H^{1.5}$					—	204	298	913
$Q_3=(3.0)(24.5)H^{1.5}$	—	74	208	544	610	773	822	1080
$Q_4=(2.5)(36)H^{1.5}$					—	53	77	236
$Q_5=(3.0)(187)H^{1.5}$						—	50	737
TOTAL CAPACITY =	0	74	208	544	692	1530	1904	4598

PROJECT 79010
LAKE HARWINTON
TORRINGTON CONN

FLAHERTY-GIAVARA ASSOCIATES
ENVIRONMENTAL DESIGN CONSULTANTS
ONE COLUMBUS PLAZA, NEW HAVEN, CONN. 06510/203/789-1260

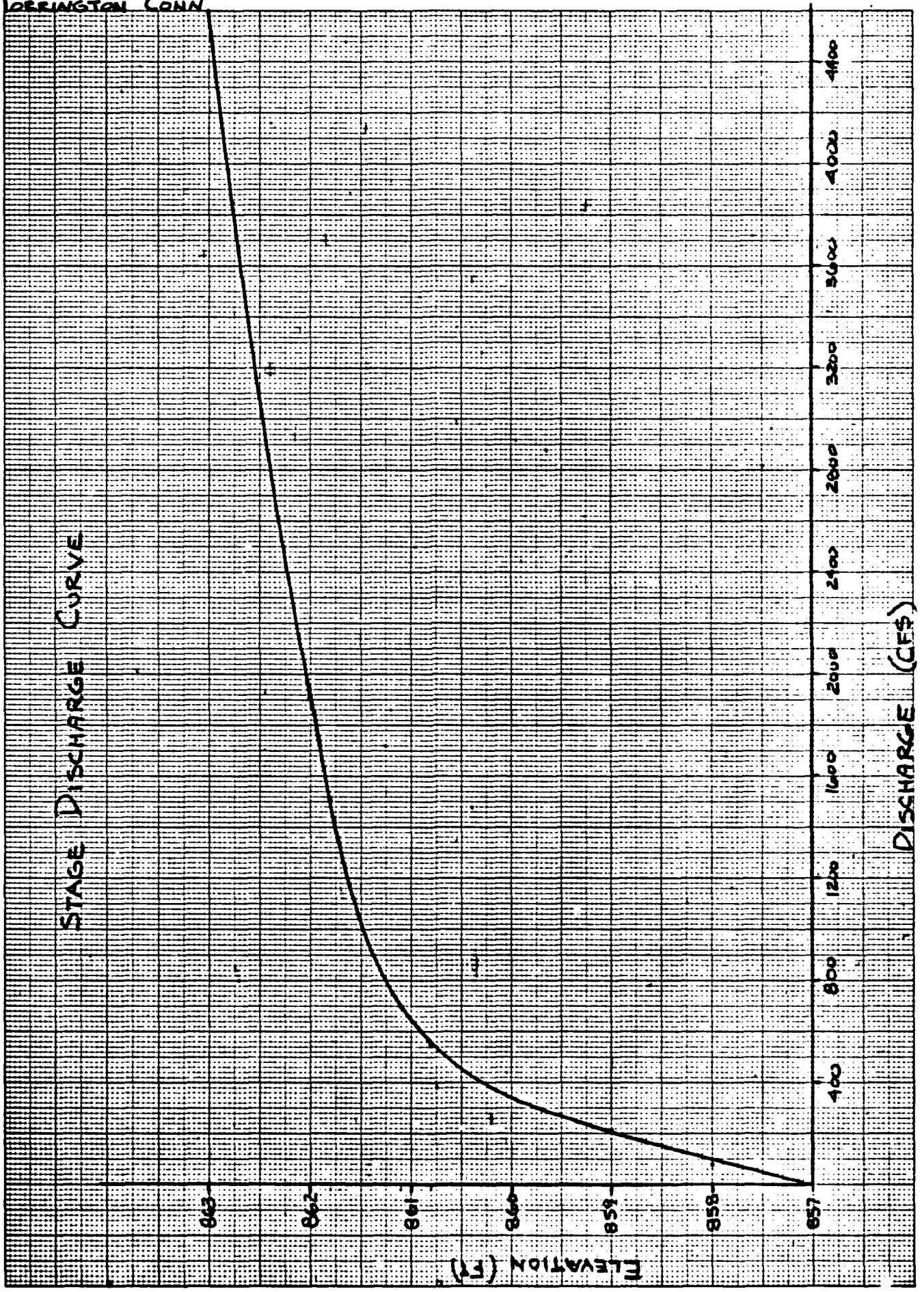
SHEET NO. 8 OF 8
BY RAC DATE 4-18-8
CHK'D. BY DKS DATE 4-24-80

HSE ELEV	BASE FLOW	FLOODWAVE	BASEFLOW FLOODING	FLOODWAVE FLOODING
785	779	795	—	10
SCHOOL 707	705	711	—	4
HOMESON LAKE PERIMETER				
10 @ 860	N/A	RES LEVEL = 860.5		0.5
5 @ 859	N/A	RES. LEVEL = 860.5		1.5

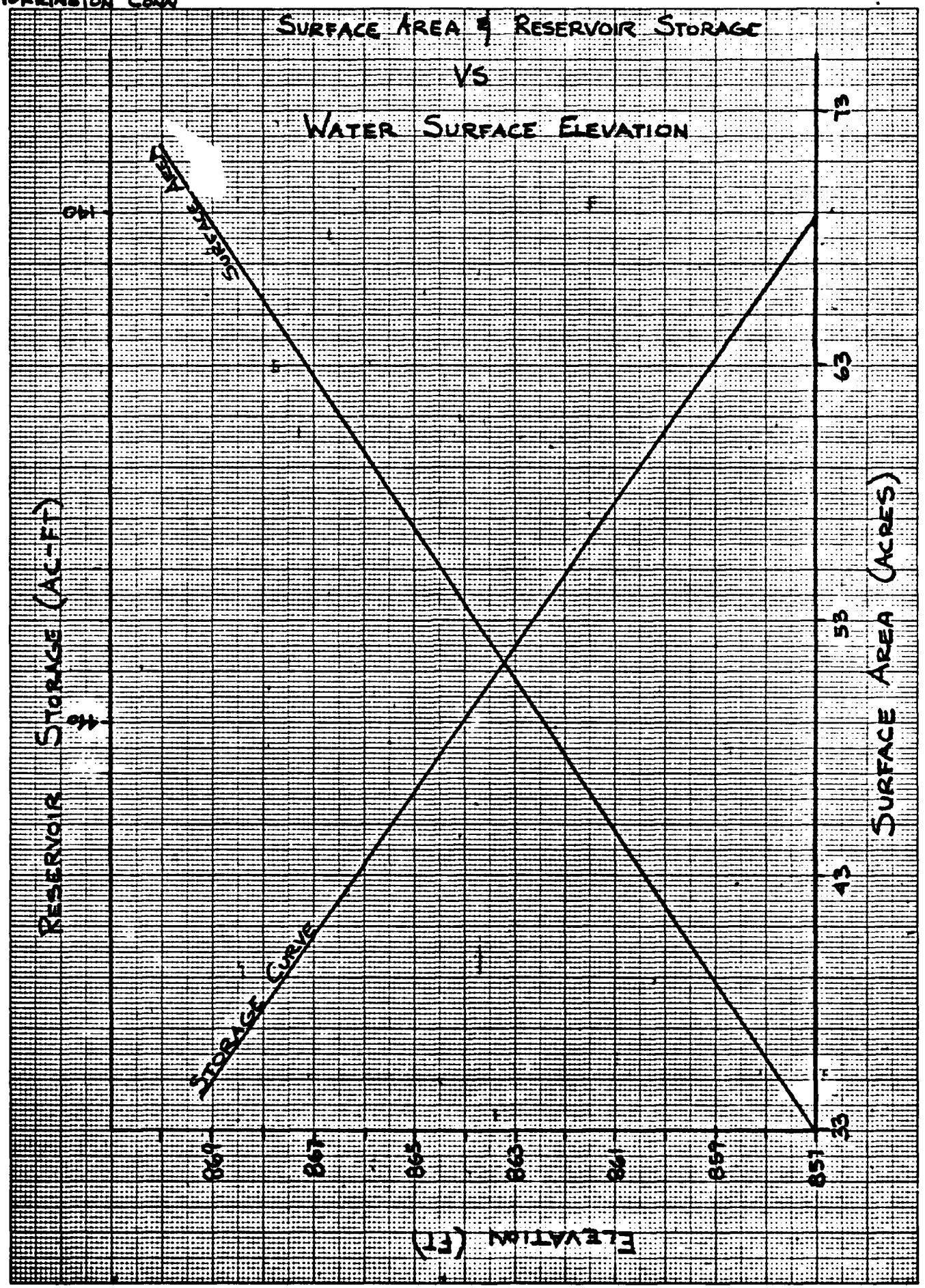


79 90 10
LAKE HARWINTON DAM
TORRINGTON CONN

RAC 4-15-80
DKS 4-24-80



SURFACE AREA & RESERVOIR STORAGE VS WATER SURFACE ELEVATION



LAKE HAWINTON DAM 799010 FLOOD ROUTING RAC JULY 11, 19

INPUT DATA: UNSUBMERGED WEIR

SEGMENT 1	DISCHARGE COEFFICIENT = 2.5	LENGTH OF WEIR = 200	ELEVATION OF WEIR = 860.8
SEGMENT 2	DISCHARGE COEFFICIENT = 2.5	LENGTH OF WEIR = 139.5	ELEVATION OF WEIR = 861.1
SEGMENT 3	DISCHARGE COEFFICIENT = 3	LENGTH OF WEIR = 24.5	ELEVATION OF WEIR = 857
SEGMENT 4	DISCHARGE COEFFICIENT = 2.5	LENGTH OF WEIR = 36	ELEVATION OF WEIR = 861.1
SEGMENT 5	DISCHARGE COEFFICIENT = 2.5	LENGTH OF WEIR = 187	ELEVATION OF WEIR = 861.8

IE=857.0 IV= 0.0 E=857.0 A= 33.10 E=870.0 A= 71.60

HOUR	INFLOW	MASS INFLOW	WATER EL.	TAIL WATER	OUTFLOW	MASS OUTFLOW	STORAGE(R)	STORAGE(A)
0.00	0CFS	0.00AC-F	857.00FT	.00FT	0CFS	0.00AC-F	0.00AC-F	0.00AC-F
1.00	235CFS	9.71AC-F	857.27FT	0.00FT	10CFS	0.44AC-F	9.26AC-F	9.26AC-F
2.00	470CFS	38.84AC-F	858.00FT	0.00FT	74CFS	3.95AC-F	34.88AC-F	34.88AC-F
3.00	706CFS	87.43AC-F	858.99FT	0.00FT	206CFS	15.58AC-F	71.85AC-F	71.85AC-F
3.70	871CFS	133.05AC-F	859.74FT	0.00FT	333CFS	31.21AC-F	101.84AC-F	101.84AC-F
4.00	837CFS	154.22AC-F	860.03FT	0.00FT	388CFS	40.16AC-F	114.06AC-F	114.06AC-F
5.00	722CFS	218.64AC-F	860.66FT	0.00FT	515CFS	77.51AC-F	141.13AC-F	141.13AC-F
6.00	608CFS	273.60AC-F	860.88FT	0.00FT	575CFS	122.60AC-F	151.00AC-F	151.00AC-F
7.00	493CFS	319.10AC-F	860.85FT	0.00FT	561CFS	169.61AC-F	149.49AC-F	149.49AC-F
8.00	378CFS	355.09AC-F	860.66FT	0.00FT	514CFS	214.09AC-F	141.00AC-F	140.99AC-F
9.00	263CFS	381.58AC-F	860.35FT	0.00FT	451CFS	254.00AC-F	127.58AC-F	127.58AC-F
10.00	149CFS	398.60AC-F	859.95FT	0.00FT	372CFS	288.03AC-F	110.57AC-F	110.57AC-F
11.00	34CFS	406.16AC-F	859.47FT	0.00FT	285CFS	315.24AC-F	90.92AC-F	90.92AC-F
11.30	0CFS	406.59AC-F	859.31FT	0.00FT	259CFS	322.00AC-F	84.59AC-F	84.58AC-F

FGA FLOOD WAVE ROUTING

APPROXIMATE FLOOD WAVE ROUTING BASED UPON U.S. ARMY CORPS OF ENGINEERS' "RULE OF THUMB GUIDANCE FOR ESTIMATING DOWNSTREAM DAM FAILURE HYDROGRAPHS" DATED APRIL, 1978.

INITIAL STATION = 0 +0
INITIAL BASE FLOW = 544 CFS
INITIAL WAVE HEIGTH = 35.0 FT
ASSUMED BREACH WIDTH = 235.0 FT
INITIAL RESERVOIR STORAGE = 344 ACRE-FT
COMPUTED FLOOD WAVE PEAK FLOW = 81,762 CFS
TOTAL FLOOD WAVE PEAK FLOW = 82,306CFS

STATION 1 +80

OFFSET	ELEV.	OFFSET	ELEV.	OFFSET	ELEV.
		N = 0.070			
-490.0 FT	880.0 FT	-300.0 FT	860.0 FT	-190.0 FT	840.0 FT
-100.0 FT	830.0 FT	-12.0 FT	830.0 FT		
		N = 0.060			
-12.0 FT	830.0 FT	-8.0 FT	828.0 FT	8.0 FT	828.0 FT
12.0 FT	830.0 FT				
		N = 0.070			
12.0 FT	830.0 FT	100.0 FT	830.0 FT	240.0 FT	850.0 FT
330.0 FT	870.0 FT	340.0 FT	880.0 FT	600.0 FT	880.0 FT

AREA	WETTED PERIMETER	N	VELOCITY	FLOW
3,528.0 SF	237.8 FT	0.070	9.9 FPS	35,021CFS
534.6 SF	24.9 FT	0.060	14.8 FPS	7,913CFS
3,299.7 SF	232.2 FT	0.070	9.6 FPS	31,831CFS

INVERT	DEPTH	W. SURFACE	AREA	VELOCITY	FLOW	SLOPE
828.0 FT	22.6 FT	850.6 FT	7,362 SF	10.1 FPS	74,766 CFS	0.0060

BASE FLOW = 544 CFS BASE STAGE = 831.0 FT.

STATION 11+70

OFFSET	ELEV.	OFFSET	ELEV.	OFFSET	ELEV.
		N = 0.070			
-230.0 FT	900.0 FT	-140.0 FT	850.0 FT	-80.0 FT	830.0 FT
-12.0 FT	824.0 FT				
		N = 0.060			
-12.0 FT	824.0 FT	-8.0 FT	822.0 FT	8.0 FT	822.0 FT
12.0 FT	824.0 FT				
		N = 0.070			
12.0 FT	824.0 FT	100.0 FT	830.0 FT	180.0 FT	850.0 FT
240.0 FT	870.0 FT	340.0 FT	900.0 FT		

AREA	WETTED PERIMETER	N	VELOCITY	FLOW
1,750.1 SF	120.8 FT	0.070	9.7 FPS	17,097CFS
583.2 SF	24.9 FT	0.060	15.6 FPS	9,148CFS
2,281.2 SF	156.7 FT	0.070	9.8 FPS	22,356CFS

INVERT	DEPTH	W. SURFACE	AREA	VELOCITY	FLOW	SLOPE
822.0 FT	24.6 FT	846.6 FT	4,614 SF	10.5 FPS	48,602 CFS	0.0060

BASE FLOW = 544 CFS BASE STAGE = 826.2 FT.

STATION 20 +0

OFFSET	ELEV.	OFFSET	ELEV.	OFFSET	ELEV.
		N = 0.070			
-790.0 FT	900.0 FT	-410.0 FT	850.0 FT	-380.0 FT	840.0 FT
-220.0 FT	830.0 FT	-50.0 FT	820.0 FT	-12.0 FT	816.0 FT
		N = 0.060			
-12.0 FT	816.0 FT	-8.0 FT	814.0 FT	8.0 FT	814.0 FT
12.0 FT	816.0 FT				
		N = 0.070			
12.0 FT	816.0 FT	110.0 FT	820.0 FT	210.0 FT	830.0 FT
240.0 FT	840.0 FT	340.0 FT	850.0 FT	480.0 FT	860.0 FT
580.0 FT	880.0 FT				

AREA	WETTED PERIMETER	N	VELOCITY	FLOW
1,589.0 SF	229.2 FT	0.070	7.7 FPS	12,262CFS
407.1 SF	24.9 FT	0.060	15.9 FPS	6,487CFS
1,935.1 SF	202.6 FT	0.070	9.5 FPS	18,489CFS

INVERT	DEPTH	W. SURFACE	AREA	VELOCITY	FLOW	SLOPE
814.0 FT	17.2 FT	831.2 FT	3,931 SF	9.4 FPS	37,239 CFS	0.0100

BASE FLOW = 544 CFS BASE STAGE = 817.7 FT.

STATION 30 +0

OFFSET	ELEV.	OFFSET	ELEV.	OFFSET	ELEV.
		N = 0.070			
-720.0 FT	850.0 FT	-510.0 FT	840.0 FT	-290.0 FT	830.0 FT
-70.0 FT	810.0 FT	-30.0 FT	800.0 FT	-12.0 FT	798.0 FT
		N = 0.060			
-12.0 FT	798.0 FT	-8.0 FT	796.0 FT	8.0 FT	796.0 FT
12.0 FT	798.0 FT				
		N = 0.070			
12.0 FT	798.0 FT	30.0 FT	800.0 FT	100.0 FT	810.0 FT
160.0 FT	820.0 FT	300.0 FT	830.0 FT		

AREA	WETTED PERIMETER	N	VELOCITY	FLOW
805.2 SF	112.5 FT	0.070	10.5 FPS	8,514CFS
443.6 SF	24.9 FT	0.060	22.6 FPS	10,044CFS
1,041.7 SF	118.1 FT	0.070	12.1 FPS	12,664CFS

INVERT	DEPTH	W. SURFACE	AREA	VELOCITY	FLOW	SLOPE
796.0 FT	18.8 FT	814.8 FT	2,290 SF	13.6 FPS	31,223 CFS	0.0180

BASE FLOW = 544 CFS BASE STAGE = 799.4 FT.

STATION 41 +0

OFFSET	ELEV.	OFFSET	ELEV.	OFFSET	ELEV.
		N = 0.070			
-780.0 FT	810.0 FT	-620.0 FT	800.0 FT	-580.0 FT	790.0 FT
-350.0 FT	790.0 FT	-210.0 FT	780.0 FT	-30.0 FT	770.0 FT
-12.0 FT	762.0 FT				
		N = 0.060			
-12.0 FT	762.0 FT	-8.0 FT	760.0 FT	8.0 FT	760.0 FT
12.0 FT	762.0 FT				
		N = 0.070			
12.0 FT	762.0 FT	40.0 FT	770.0 FT	110.0 FT	780.0 FT
420.0 FT	790.0 FT	550.0 FT	790.0 FT		

AREA	WETTED PERIMETER	N	VELOCITY	FLOW
732.5 SF	157.1 FT	0.070	10.7 FPS	7,882CFS
414.9 SF	24.9 FT	0.060	29.3 FPS	12,168CFS
528.9 SF	83.0 FT	0.070	13.2 FPS	7,010CFS

INVERT	DEPTH	W. SURFACE	AREA	VELOCITY	FLOW	SLOPE
760.0 FT	17.6 FT	777.6 FT	1,676 SF	16.1 FPS	27,060 CFS	0.0330

BASE FLOW = 544 CFS BASE STAGE = 762.9 FT.

STATION 51 +0

OFFSET	ELEV.	OFFSET	ELEV.	OFFSET	ELEV.
		N = 0.070			
-700.0 FT	750.0 FT	-320.0 FT	730.0 FT	-110.0 FT	720.0 FT
-12.0 FT	711.0 FT				
		N = 0.060			
-12.0 FT	711.0 FT	-8.0 FT	709.0 FT	8.0 FT	709.0 FT
12.0 FT	711.0 FT				
		N = 0.070			
12.0 FT	711.0 FT	100.0 FT	720.0 FT	450.0 FT	750.0 FT

AREA	WETTED PERIMETER	N	VELOCITY	FLOW
616.4 SF	130.7 FT	0.070	13.3 FPS	8,228CFS
292.8 SF	24.9 FT	0.060	28.6 FPS	8,379CFS
545.0 SF	106.4 FT	0.070	14.1 FPS	7,685CFS

INVERT	DEPTH	W. SURFACE	AREA	VELOCITY	FLOW	SLOPE
709.0 FT	12.5 FT	721.5 FT	1,454 SF	16.7 FPS	24,293 CFS	0.0500

BASE FLOW = 544 CFS BASE STAGE = 711.6 FT.

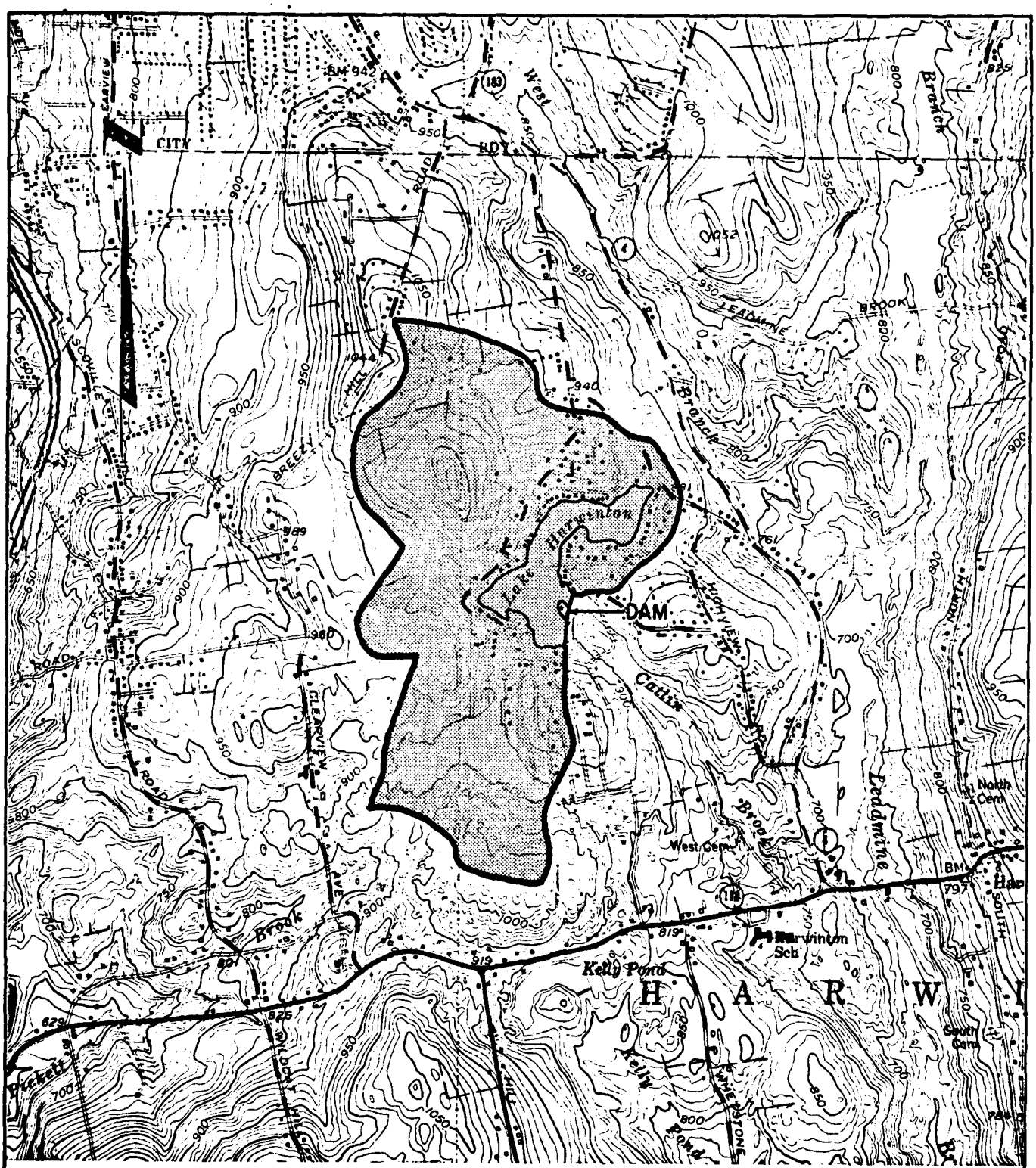
STATION 55 +0

OFFSET	ELEV.	OFFSET	ELEV.	OFFSET	ELEV.
		N = 0.070			
-1200.0 FT	710.0 FT	-950.0 FT	700.0 FT	-60.0 FT	700.0 FT
-12.0 FT	698.0 FT				
		N = 0.060			
-12.0 FT	698.0 FT	-8.0 FT	696.0 FT	8.0 FT	696.0 FT
12.0 FT	698.0 FT				
		N = 0.070			
12.0 FT	698.0 FT	1100.0 FT	700.0 FT	1150.0 FT	710.0 FT

AREA	WETTED PERIMETER	N	VELOCITY	FLOW
1,166.5 SF	967.4 FT	0.070	4.3 FPS	5,096CFS
116.1 SF	24.9 FT	0.060	12.5 FPS	1,457CFS
2,368.8 SF	1093.9 FT	0.070	6.4 FPS	15,290CFS

INVERT	DEPTH	W. SURFACE	AREA	VELOCITY	FLOW	SLOPE
696.0 FT	5.1 FT	701.1 FT	3,651 SF	5.9 FPS	21,844 CFS	0.0330

BASE FLOW = 544 CFS BASE STAGE = 698.5 FT.



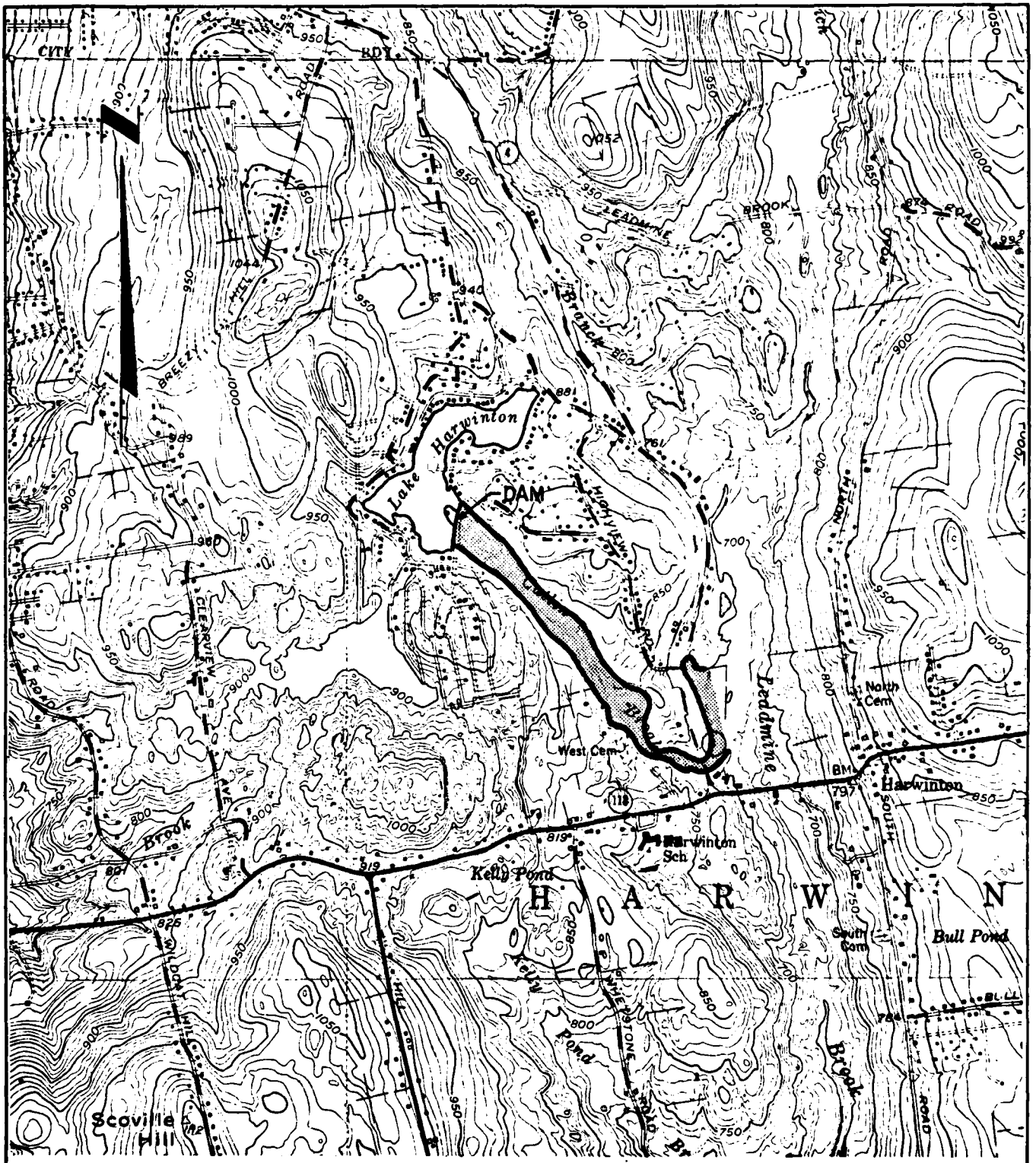
SCALE IN FEET

2000 1000 0 2000

LAKE HARWINTON DAM
DRAINAGE MAP

HARWINTON , CONNECTICUT

FLAHERTY • GIAVARA ASSOCIATES, P.C.



LAKE HARWINTON DAM
DAM FAILURE ANALYSIS
IMPACT AREAS

HARWINTON , CONNECTICUT

FLAHERTY • GIAVARA ASSOCIATES, P.C.

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

(1) STATE	(2) IDENTITY NUMBER	(3) DIVISION	(4) STATE	(5) COUNTY	(6) CONGR DIST.	(7) STATE	(8) COUNTY	(9) CONGR DIST.	(9) NAME	(10) LATITUDE (NORTH)	(11) LONGITUDE (WEST)	(12) REPORT DATE DAY | MO | YR
CT	3[illegible]	[illegible]	09	005	06				LAKE HARWINTON DAM	4146.7	7304.9	01MAY80

(13) POPULAR NAME	(14) NAME OF IMPOUNDMENT
	LAKE HARWINTON

(15) REGION	(16) BASIN	(17) RIVER OR STREAM	(18) NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	(19) DIST FROM DAM (MI.)	(20) POPULATION
01	10	CATLIN BROOK	HARWINTON	1	5100

(21) TYPE OF DAM	(22) YEAR COMPLETED	(23) PURPOSES	(24) STRUCTURAL HEIGHT (FT.)	(25) HYDRAULIC HEIGHT (FT.)	(26) IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT.)	(27) IMPOUNDING CAPACITIES NORMAL (ACRE-FT.)	DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
[illegible]PG	1930	R	30	26	300	140	NED	N	N	N	N	

(28) REMARKS

20=ESTIMATE 22=ESTIMATE 24=DIKE >.35FT

(29) D/S HAS	(30) SPILLWAY CREST LENGTH	(31) SPILLWAY TYPE	(32) SPILLWAY WIDTH (FT.)	(33) MAXIMUM DISCHARGE (FT.)	(34) VOLUME OF DAM (CY)	(35) POWER CAPACITY INSTALLED (MW)	(36) POWER CAPACITY PROPOSED (MW)	(37) NAVIGATION LOCKS NO.	(38) LENGTH (FT.)	(39) WIDTH (FT.)	(40) LENGTH (FT.)	(41) WIDTH (FT.)	(42) LENGTH (FT.)	(43) WIDTH (FT.)	(44) LENGTH (FT.)	(45) WIDTH (FT.)
1	561	U	25	500			0									

(46) OWNER	(47) ENGINEERING BY	(48) CONSTRUCTION BY
LAKE HARWINTON ASSOC.		

(49) REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
CONN DEP	CONN DEP	CONN DEP	CONN DEP

(50) INSPECTION BY	(51) INSPECTION DATE DAY | MO | YR	(52) AUTHORITY FOR INSPECTION
FLAHERTY GIAVARA ASSOCIATES	15NOV79	P.L. 92-367

(53) REMARKS

46=R.CASSELLO PRES.30=56FT>DAM 18FT>DIKE


FILMED